The Mining Journal

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Vol. CCXLV No. 6262 — LONDON, AUGUST 26, 1955 — PRICE 8d.

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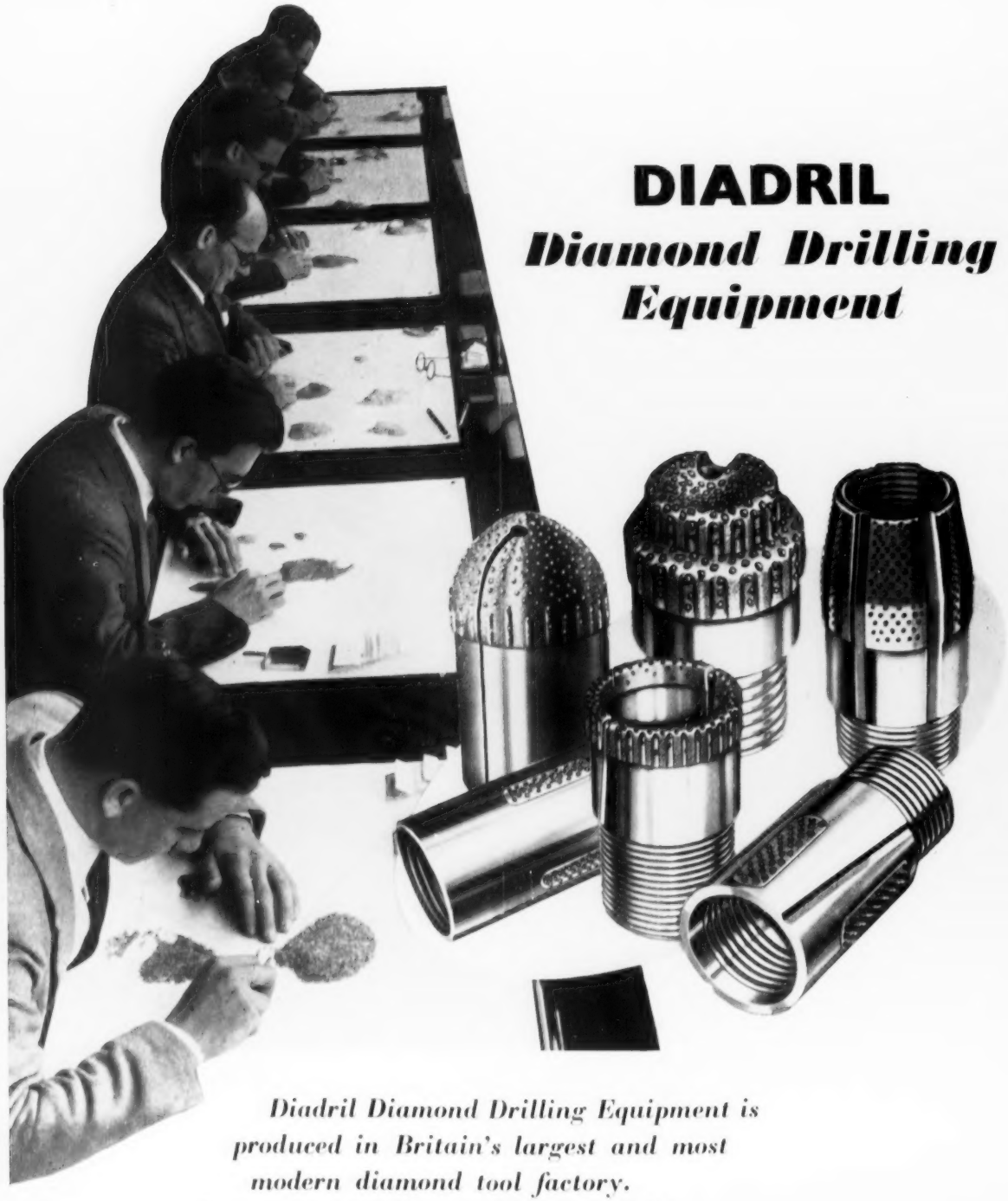

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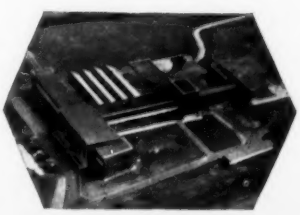

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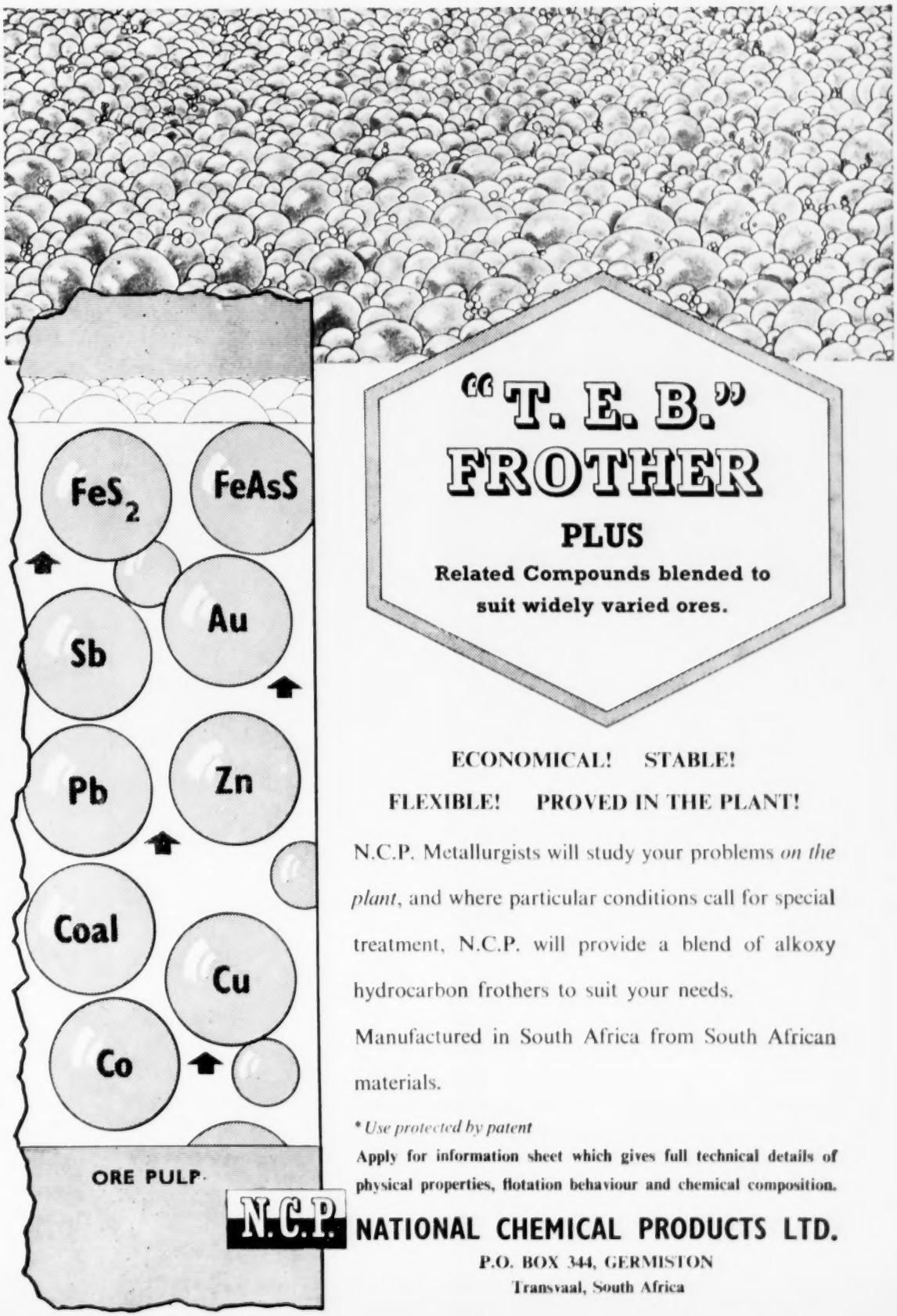

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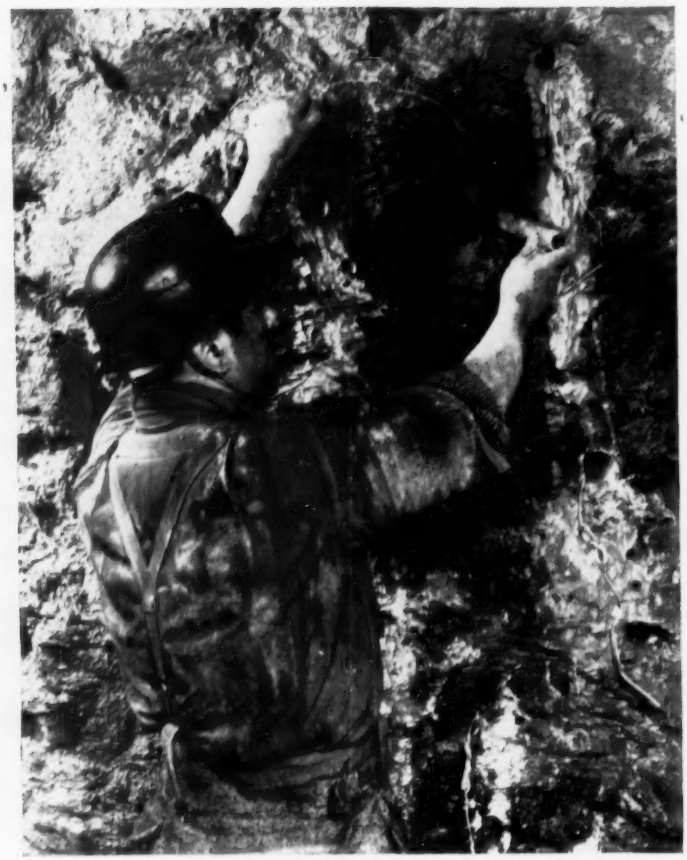

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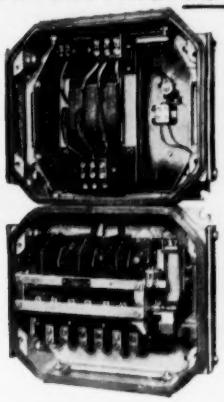

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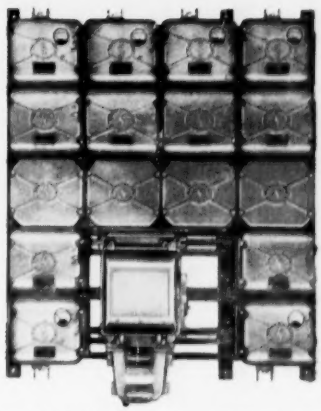

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Published by The Mining Journal Ltd., at 15 Wilson Street, Moorgate, London, E.C.2. MONarch 2567 Subscription £2 per annum

NOTES AND COMMENTS

The Geneva Atoms for Peace Exhibition and the Mining Industry

The first International Conference on the peaceful uses of atomic energy and International Atom Trade Fair which opened in Geneva on August 7 and came to an end last Saturday has done more to condition the world to the fact that mankind is now living in the atomic age than any other single event since Hiroshima. The impact on industrial, military and economic thinking of the tremendous power potential of atomic energy up to now, has only been slowly revealed. Indeed, nearly all the information available on the practical application of nuclear science has been shrouded in secrecy with the result that only a vague conviction could be held that the atomic age would be a practical proposition this century.

But the Geneva Atom Conference has translated what was held hitherto to be scientific theory into a hard commercial reality. More than that the Conference provided the forum from which the U.K., U.S.A. and the U.S.S.R. lifted the iron veils of secrecy on several of the scientific techniques and processes so necessary to the harnessing and development of atomic energy.

Quite apart from the invaluable data revealed in the thousand or so papers either presented at the Conference or still to be published, which will stand as basic material for all those who wish to understand the new age in which we live, the most penetrating repercussions of the Conference may well have manifested themselves through the Exhibition held at the Palais des Exposition featuring commercial atomic equipment.

At the Commercial Exhibition, British industry made a strong bid for its share of potential nuclear energy business. The U.K. Atomic Energy Authority in its 7,000 sq. ft. exhibit, provided a particularly well conceived and designed picture of developments in the atomic energy field in Britain. The industrial group responsible for the design, construction and operation of Britain's atomic factories presented the Springfields Uranium Production Plant where uranium metal is extracted from the crude ore; Windscale, where plutonium is separated, and its Capenhurst factory where depleted uranium is enriched for re-use. A model of Britain's first nuclear power station at Calder Hall was on display and the companies which collaborated with the U.K. Atomic Energy Authority in its construction, also exhibited. Taylor Woodrow Ltd., the main contractors for the buildings, showed by illustrations, the plant under construction. Incidentally, Babcock and Wilcox Ltd. and English Electric also shared in the construction of the 50,000 kW. station and these three companies have joined forces to offer complete atomic power stations under one contract. Models demonstrating the fast breeder reactor at Dounreay and DIDO, the research reactor now under construction at Harwell, were also on view.

Of particular interest to the mining industry were the displays by manufacturers of nucleonic instruments. Isotope Developments Ltd. featured a prototype scintillation counter for field use weighing only 5½ lb., whilst Panax Ltd., Ericsson Telephones Ltd., The Automatic Coil Winder and Electrical Equipment Co. Ltd., and E. K. Cole Ltd. were displaying their range of ratemeters for prospecting and geological survey purposes. Fleming Radio Developments Ltd. demonstrated radio-active dust sampling equipment. Basically, this unit is a household suction cleaner with a special nose-piece containing a filter paper holder and an anemometer. Dust from the air is collected by filtration, the total air passed in a given time being measured by the anemometer .

The Union Miniere des Haut Katanga's stand was devoted to its uranium mining operations in the Belgian Congo and a large collection of uranium minerals was on view. Nearby Craelius Ltd. displayed their range of diamond drills.

Canada featured the blind river uranium deposits with photographs and maps, whilst France had a small exhibit showing uranium mining operations.

The U.S.S.R. did not exhibit at the Palais des Expositions but had a large official exhibit at the Palais des Nations where the Conference was held. In this connection it is germane to point out that very little was learned at the Conference regarding Russia's resources of uranium ores. And although their display included a large collection of minerals,

no indication was given regarding mining operations. However, Russia's official exhibit showed equipment designed for the radio-active logging of boreholes and there was also a Stand illustrating one of the surveys conducted on the geochronology of the pre-cambian rocks of the Ukranian crystalline massif.

The U.S.A. exhibit featured a radio-metric laboratory and a model of a pile where actual operation was simulated and described. Union Carbide, which operates uranium mines on the Colorado Plateau and also manufactures a wide range of materials for atomic plant, had an impressive display which included photographs and diagrams of mining operations.

The Atomic Development Mutual Find Incorporated, an investment company whose policy is based on the increased importance of atomic science, showed a plan of where its various interests are situated in addition to giving a comprehensive picture of the atomic industry in the U.S.A., Africa and Australia.

R.S.T. Bonus Payments Based on L.M.E. Quotation

With copper markets eyeing nervously the various bones of contention that lie around the world's copper mines it is a relief to record that one bone has been removed; even if it was only a little one and scarcely likely to cause an overt eruption. When R.S.T. began to sell its copper at a fixed price and at a level well below the London Metal Exchange quotation those of its employees in receipt of copper bonus, in effect, took a cut in pay. Whatever one's views of R.S.T.'s selling policy this was an unfortunate consequence and a dispute arose. It has now been settled by R.S.T. agreeing to value (and retrospectively) copper sales for the purpose of computing bonus on the basis of L.M.E. quotations. Needless to say there is no ground for supposing that this is the first step in the trek back to accepting L.M.E. quotations for pricing R.S.T.'s copper.

The significance of the dispute lay in that it provided the link between the two important issues on which the copper companies are deeply divided. R.S.T. and Anglo American have different views on the pace and control of African advancement and on how to achieve a greater stability of copper prices. But the issues themselves were clearly unrelated. However, R.S.T.'s action in fixing copper prices, because it involved a cut in bonus, brought what was hitherto a strictly commercial matter into the area of labour relations and collective bargaining—the area to which the African advancement problem properly belongs. To a certain extent this was coincidental. There is no reason why R.S.T.'s selling price should always be below L.M.E. price and the boot would then be on the other foot. This raises another problem. Circumstances could arise in which the L.M.E. quotation fluctuated around the R.S.T. price—sometimes above, sometimes below it. Would the European Union then demand a switching from one basis to another in search of the higher bonus computation? There seems to be a strong case—so long as two pricing systems exist simultaneously — for hitching the bonus computation unequivocally to the L.M.E. quotation simply because it is made by professionals with no interest in the copper bonus and not by one party to a collective bargain. This is a hypothetical case—but it need not always be—and the art of industrial relations is in foreseeing and forstalling trouble. All that needs to be said now is that it is fortunate that the dispute has been settled in this particular way. Inevitably R.S.T., in so far as it has refused to accept the European Union's views of African advancement in an important particular —the right of veto—must be less popular with that Union than Anglo American which has found possible to accept the veto. It would be unfortunate if obloquy were to be further heaped on R.S.T.'s head for appearing to want to cut the European's bonus. For the cut in bonus was an indirect consequence and not a determinant of the new selling policy. It is a pity that these two great companies are still divided; but, so long as they are, the issue on which they are divided should be kept separate for only thus can they be evaluated dispassionately.

Aerial Survey of the Midlands

Although a great deal of geological information has already been obtained about Great Britain by surveying supplemented by boring operations, information concerning the deeper-lying strata is sketchy.

Airborne magnetometer surveys have been particularly valuable in revealing worthwhile geological data at depth in North America and Africa and the successes achieved on those two continents has probably influenced the recent decision to carry out an airborne magnetometer survey of the Midlands. The area selected for the survey covers 11,000 sq. miles bounded by Stockport, Market Rasen (Lincolnshire), Luton and Gloucester which includes a variety of flat and hilly country and poses a wide range of geological problems.

This survey, which began last week, was initiated on the recommendation of the D.S.I.R. although actual operations are being financed by the Nuffield Foundation. It is uncertain whether the geological and economic results will justify the use of aerial surveying. Yet geological data about the deeper-lying strata of this country is especially desirable now—which accounts for the aerial surveying being closely associated with the Geological Survey's programme of deep boring.

The aircraft will fly across the area to be surveyed at a minimum height of 1,000 ft. Airborne operations are expected to be completed by October and the calculations and maps made from the survey by the end of this year.

French Overseas Mining Developments

The French Overseas Mining Bureau, which is a government controlled institution established to promote research and mining development in the French Overseas territories, recently published its annual report in which is listed the salient mining developments in 1954.

One of the most important developments noted refers to the manganese deposit at Franceville which has proved to be one of the largest in the world. There is, too, confirmation concerning the extent of the copper deposit at Akjoujt in Mauritania and of the iron deposit of Fort Gouraud. Another activity of interest listed was that relating to iron ore shipments by the Compagnie Miniere de Conacry which expanded sharply to 580,000 tons compared with only 39,000 tons in 1953. The phosphate deposit of the Taiba French West Africa is considered to be an attractive proposition and promising developments are expected. Finally, it is noted that potash research work in Gabon has yielded promising results and a rich potash deposit has already been discovered.

Bombay Metal Exchange to Enter Mining Industry

What could become a new and important factor in the Indian mining industry is—strangely enough—the newly formed Bombay Metal Exchange whose president, Mr. Abdulhusein G. Tambawala has declared that the Exchange, with the help of the government, proposed to form a Corporation for the purpose of prospecting mining possibilities in India.

One of the declared objectives of the new Exchange was to render assistance to the country with a view to its achieving near self-sufficiency in non-ferrous metals, par-

ticularly in copper and in lead. Mr. Tambawala's belief is that for the rapid industrialization of India the country must cease to rely on foreign sources for its metal supplies. At present, he did not think there was any possibility of mining zinc and tin in India but there were undeveloped sources of copper and lead. The extent to which India is currently relying on foreign sources for some metals was clearly shown in the fact that 30,000 tons of copper were imported annually which compared with a domestic output of 10,000 tons. Similarly, imports of lead totalled 15,000 tons a year as compared with a domestic production of only 3,000 tons.

Notwithstanding the many conflicting interests arising as between producers and sellers, Mr. Tambawala is prepared to provide facilities for working the mines if the proper government support and encouragement was forthcoming.

Australia

(From Our Own Correspondent)

Melbourne, July 30.

West Australian Petroleum Pty., Ltd., drilling at Exmouth Gulf, Western Australia, has advised that the No. 1A well, alongside No. 1, in which the discovery of oil was made in November, 1953, is not a commercial proposition, but would contribute a useful share if further accumulations were found in the area. This is an additional disappointment in the search for oil in Australia.

The well, in which oil was met at a depth of 3,600 ft., has been under test for several weeks, in which time a total of 16,896 bbl. of oil were produced, the rate of flow approximating 16.9 bbl. per hour. Drilling has failed to locate extensions of the concentration, which is regarded as seepage and accumulation from source beds yet to be located. The company, by the end of the year, will have spent £A10,000,000 in exploration; a number of geological and geophysical parties is in the field and four wells are being drilled in other parts of the State.

A large total sum of capital has been invested by a number of companies in Australia, and drilling is proceeding actively, but results, so far, have been negative. Geological opinion is favourable to ultimate success, but some waning of confidence amongst investors is indicated by forfeiture of shares in No Liability companies, and some anxiety as to finances may be responsible for almalgamation of interests.

WESTRALIAN GOLD PRODUCTION CURVE FLATTENS

The steady expansion in Western Australian—and consequently Australian—gold production since 1946, has practically ceased, and it would seem that the peak has been reached for the time, until there is renewed encouragement in the form of an increased price, or reduction in costs, the latter being possible only by a decrease in wages rates or an increase in working hours. Figures for Western Australia for the first half of the year show a production of 427,241 oz. and comparison with the output for the same period of 1954, 428,523 oz., shows the trend of the industry.

In the post-war period the State had lost producers in Wiluna Gold Mines and Big Bell Mines; Paringa has closed down, though there will be increasing production from its lodes by Gold Mines of Kalgoorlie, which now owns the leases. Balancing factors are the Great Western Consolidated as a new producer, and the winning of higher grade ore by Central Norseman Gold Corporation and Hill 50 Gold Mine, while there has been an increase in tonnage mined at Kalgoorlie.

NO NEW DISCOVERIES

The perturbing fact is that there have been no new discoveries of any importance in Australia. Queensland relies upon Mount Morgan and Golden Plateau almost entirely, and the Northern Territory will, in a few years, lose its big producer, Australian Development, unless exploration takes a favourable turn. Other mines in the Northern Territory report rich ore at the moment, without promise of stability. An adverse feature is the steady decrease in the numbers of prospectors, notably in Western Australia, where for many years they have maintained the large and important State battery system, treating ore for prospectors and small producers. While an increase in the price for gold will stimulate company activity, both in production and exploration, the old race of prospectors is nearly extinct, for the life no longer appeals to the younger men.

Mount Morgan Ltd., Queensland, is maintaining a steady output of ore at over 900,000 tons per year and in the past three years there has been progressive increase in the tonnage of overburden removed, which in the last year, 1954, reached 2,870,000 tons. This increase is due to the increasing depth of the open cut, the lowest bench being at 850 ft. from surface, and the preparation of the Sugarloaf section. The last published estimate of ore reserves is 16,900,000 tons, with an assay value of 2.64 dwt. gold, 1.02 per cent copper and 15 per cent sulphur. This tonnage is equivalent to a life of 18 years at the present rate of extraction. The reserve covers the original mine and the Sugarloaf extension of the orebody.

The company has been prospecting adjacent country for some time and diamond drilling may disclose further ore. It is not impossible that the conservative estimate of life may be increased. It can be expected that the rate of overburden removal will decrease, although the peak rate may still be ahead, and an increase in the copper content may also be expected. The mine is essentially a gold mine, with last year's production at 61,945 oz. Copper for that year was lower than for three years, at 5,402 tons, but a forecast of 7,000 tons in the near future may be realized. Pyrite is assuming increasing prominence with Australia's rapidly growing use of sulphuric acid. The annual production of pyrite concentrate is 180,000 tons, and estimated profit on this output is £A100,000. Maintenance of a high price for copper is important, but any moderate fall will be compensated by reduced removal of overburden influencing the cost position. At the present time the overburden-to-ore ratio is 3 :1, but the average ratio for the whole orebody is 1.8 : 1, so that there is a substantial margin for cost reduction in the future.

There is no undue optimism in predicting a big future for the Great Boulder Proprietary Mine in Kalgoorlie, Western Australia. On the cost side, the operation of the new diesel-electric power house has reduced treatment costs by £A68,000, although the plant was running for part of the year only. Working costs for the mine were 3/2 per ton lower at 54/3 per ton, a creditable achievement. Development results are good.

Above the 3,100 ft. level, orebodies of higher than average grade have been discovered in a part of the mine previously unproductive. At the south end of this level, drilling has intersected lodes of width and value that indicate persistent mineralisation to a depth of 3,540 ft., and it is considered that the system should continue in depth. Development has been commenced at the 3,250 ft. level. General mine development for the past year increased ore reserves to 2,045,100 tons, despite the extraction and milling of 470,914 tons. Grade of reserves is 5.41 dwt. gold per ton.

Mining a Flat Reef at Grootvlei Proprietary Mines, South Africa

The use of a scraper held close to a straight working face are operating factors that have aided the efficient exploitation of flat reefs at Grootvlei Proprietary Mines Ltd., the Far East Rand producer. In the following article T. L. Blunt, general manager of the property, describes the particular problems arising from flat reef mining at Grootvlei and the methods adopted to ensure efficient exploitation. The article is condensed from a paper presented at the Centenary Congress of the Société de l'Industrie Minérale held in Paris during June, 1955.

The Grootvlei orebody lies at an average inclination of about six deg. dipping in a southerly direction. This orebody is a conglomerate having a quartzite hanging wall and a shale footwall and varying in depth from 2,800 ft. to 4,600 ft. below surface. The average width of the reef is 14.2 in., the average reef channel width is 18.6 in. and the average stope width is 39.1 in. The tonnage milled per month is 185,000 tons and in order to obtain this tonnage an area of 17,615 sq. fm. has to be excavated, i.e., roughly 14½ acres.

The leased area is served by four vertical shafts. No. 5 is an upcast shaft and used only for ventilation, while numbers 3, 4 and 6 are downcasts and used for hauling men, material and ore. Transport underground is of two main types, endless rope haulages and locomotive haulages, two of the latter are large haulages with 20 ton locomotives of the overhead trolley wire type for rapid transport to the outlying parts of the mine, the others consist of smaller overhead trolley wire, electric battery and diesel locomotives. The smaller units are generally used as gathering machines and collect trucks from stopes and bring them to the main haulages for transport to the shafts and thence to the surface.

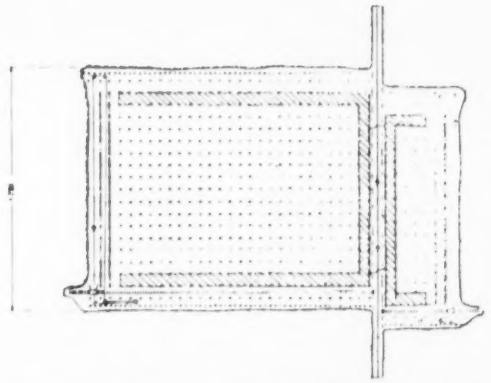
Main developing drives are connected by raise winze connections so that through ventilation can be obtained as far as possible at all times, and it is from these raise winze connections that stoping of the orebody or reef takes place. Due to the variations in dip of the reef some of these are about 500 ft. long while others are as much as 1,000 ft.

NEW STOPING METHOD

The latest method of stoping is to take out the middle third of the ground in the raises while development is being carried on to the boundaries of the lease area and taking the remaining two-thirds out when the boundaries have been mined and retreating towards the shafts has commenced. In this way standard mining faces are obtained and there are two faces available on the retreat for each one available as the development advances towards the boundaries.

Raises are driven 12 ft.×8 ft. throughout, the hanging wall of the raises being the eventual hanging wall of the stope and the surplus height being gained in the shale footwall. After they have holed they are equipped with scrapers operated on the endless rope haulage principle with a 4 ft. capstan wheel and 60 h.p. electric motor. As soon as this equipment has been installed ledging of the middle third of the raise commences. By ledging is meant blasting out the reef from the hanging wall to the contact between reef and shale.

After ledging has been carried from 20 to 30 ft. from the original raise two cuttings are blasted in the footwall one at the bottom of the panel and one at the top. These are equipped with light gauge tracks. The bottom one has one or two trucks for bringing the ore from the loading points to the original raise as well as for taking in materials required in the stope. The top one is used as a means of ingress at blasting time as well as for servicing when required. Waste from these cuttings as well as that sorted in the face is used for stone walling the side of the original raise as well as the raise side of the bottom cutting and the dip side of the top cutting. A brattice is hung in the original raise or gully at the two strike walls in order to course the ventilating current on to the working face. As soon as the face has advanced sufficiently far from the gully a 15 h.p. double drum scraper hoist is mounted with the head rope and scraper in the face and the tail rope with scraper two lines of mat packs away from the face.



The 15 h.p. double drum scraper hoist mounted with head rope and scraper in the face and tail rope with scraper two lines of matt packs away from face.

The blasted rock is allowed to build up on dip between the packs to form a scatter pile. These scatter piles are built to prevent rock from the blast being thrown back into the excavated area which must be swept up to the tail rope at all times. As soon as a new scatter pile has been built the one furthest from the face is removed on the tail rope. The head rope is advanced as the face advances while the tail rope is taken off the drum and round into the next space between lines of matt packs as soon as the back scatter pile has been removed and swept. Toes are carried at the top and bottom of the face to ensure that the sheave wheels carrying the head rope are able to keep it as near as possible to the face.

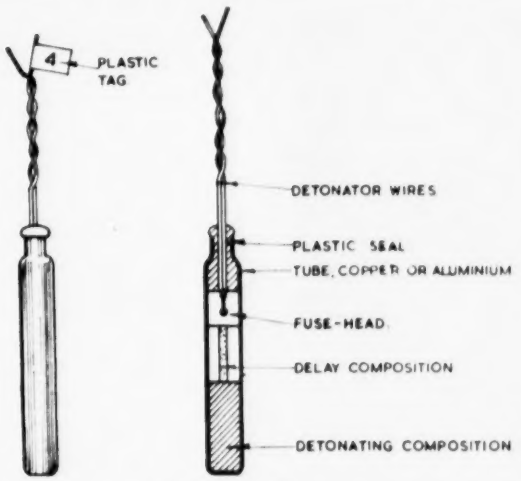
The face scrapers load the broken ore over simple rough timber boxes into the trucks which take it to the main gully where it is tipped and again picked up by the endless rope scraper and filled into standard mine trucks in the drive for transport to the hoisting shafts. Timber for support is carried up the stope on the scraper which has a frame made of second-hand 1 in. pipes set in it for this purpose. The frame is removed when pulling ore.

A few of the salient features of face scraping are that the face must be kept straight as labour is not supplied to lash the rock in the face to the scraper, the scraper must be brought to the rock and not the rock to the scraper, stope labour works as a team and not as individual labourers for individual jobs. Thus with migratory labour it is found that when labourers leave for their homes production is more or less maintained by the team.

Short Delay Detonators in Rippings

Trials already carried out in the United Kingdom with short delay detonators in rippings at collieries suggest that there are many places where the use of these equipments would be advantageous. In the following article, condensed from *Information Bulletin 55/143*, published by the National Coal Board, a brief description of these detonators and the trials to which they have been submitted is given. It is noted that at collieries where the use of permitted explosives is required by the Coal Mines (Explosives) Order, September 17, 1951, short delay detonators can be used in rippings only by permission of H.M. Inspector of Mines.

The essential difference between an instantaneous and a delay detonator is the presence in the latter of a delay element inserted between the fuse head and the priming charge. Variations in the length and chemical composition of this element allow delays of differing intervals to be obtained. This delay type of detonator was first used (in coalmining) for stone drifting, where, at first, the successive delay intervals were one second. However, it was soon found that half-second intervals were satisfactory and for some years this period delay has been standard practice in stone drifting.



Short Delay Detonator.

The major advantage of this method of shotfiring is that it permits of a number of shots being prepared and fired as one round, the delay elements ensuring that the individual shots detonate in succession, according to a pre-arranged plan. It should be remembered that the actual number of shots is limited to six by Article 25 (5) of the Coal Mines (Explosives) Order, September 17, 1951, even where permitted explosives are not required to be used Delay action firing is an improvement on instantaneous firing of the same round when shots are required on more than one horizon and relief is needed by the detonation of the lower before the higher shots.

The chief disadvantage of delay-action firing is the possibility that firedamp may be released by the earlier shots in a round and ignited by later shots. It is considered that this ignition risk only arises if the interval between the first and last shots of a round is more than 100 milli-seconds varying according to circumstances. The use of short-delay detonators make it possible to keep within these limits.

If only the risk of gas ignition is considered, the shortest delay period possible is desirable, but it has been found that the type of detonator with the 25 milli-second interval could ignite firedamp when fired alone, in the open, in an explosive mixture. In practice this is a remote contingency, but a 50 milli-second series using a different material for the sleeve of the delay element has been evolved to overcome this danger. Further research work is proceeding.

Apart from the obvious saving in time by firing six shots in a round in rippings, several other advantages have been claimed by the management at collieries where the work has been carried out. These advantages are :—

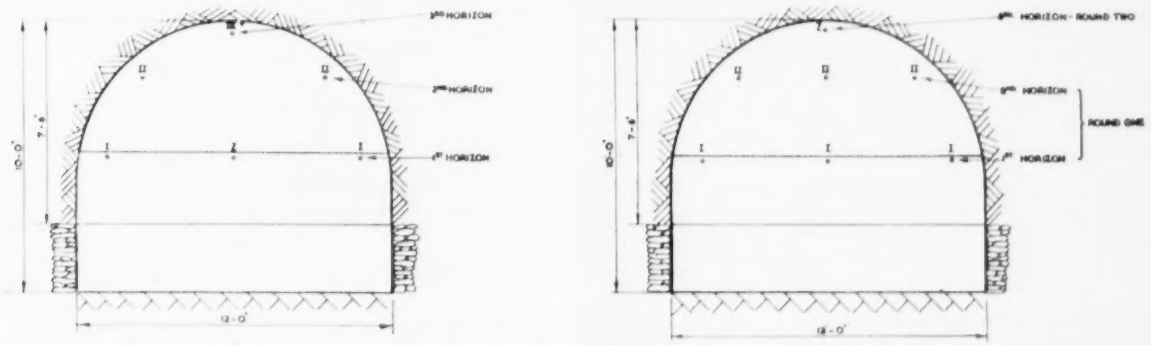
(a) Improved fragmentation where the ripping is a hard material and difficult to break by normal shotfiring methods to a suitable size for packing ;

(b) Reduction in the number of shots required in large stones on the ground and in irregular projections left on the side of roadways ;

(c) Reduction of fumes and dust in some instances ; and

(d) Reduction in the number of shots fired in ripping lips and/or the total amount of explosive used.

A difficulty which might be anticipated from the use of short-delay detonators is a cut-off, where one shot breaks through into another shothole before the charge in the latter has detonated. So far as is known this has happened at only one colliery, on three occasions. The ripping lip in question contained marked but irregular horizontal laminations and the shots were being fired with two delay periods at one horizon. Although this firing pattern possessed advantages from the point of view of blasting efficiency, it has now been recommended in order to avoid cut-offs, that only one delay period be used on each horizon.



Shothole patterns. At left, pattern when cut-offs took place, and at right the reversed pattern. Roman numerals denote delay period and Z zero delay.

Use of Hot Compressed Air at the Kiruna Mine

Kiruna, Sweden's high-grade iron ore mine lies within the Arctic circle and naturally experiences very low temperatures. The problems of freezing pipe lines and cold workings underground are, therefore, considerable to overcome which the company had adopted a decentralized hot air supply system and this is described in the following article.

The Atlas wagon drill BUK 21K in operation at Kiruna mines.

The high-grade iron ore in Sweden's Kiruna mine has hitherto been excavated chiefly by open cut. The economic limit of surface working has now, however, been reached, and a gradual change to underground caving, expected to be completed in the early nineteen-sixties, is already in progress. The development programme provides for a production of 12,000,000 tons of ore a year, which will make it the largest underground mining project carried out in the world.

The method followed is the sub-level caving method developed for extensive mechanization without the use of tracks. From the transverse drifts, which measure 16 ft. 5 in. x 11 ft. 4½ in. (5 x 3.5 m.), the ore is being worked by special drilling units (BUK 21K) developed by Atlas Diesel in close co-operation with Luossavaara-Kiirunavaara AB.

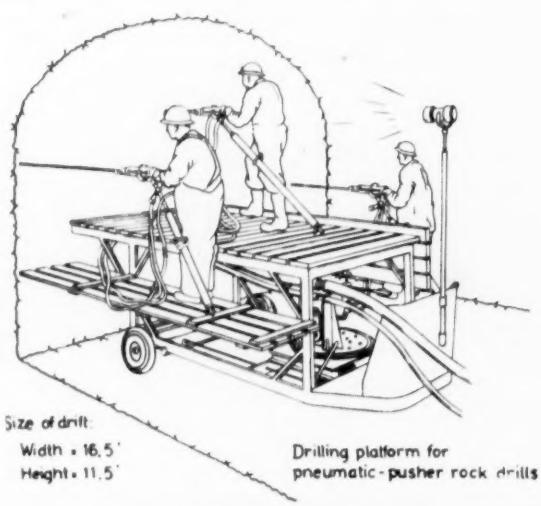
The supply of compressed air to the numerous workings has raised several difficult technical problems. The ore body extends over more than 2 1/5 miles (3.5 km.), necessitating the provision of an extremely extensive and complicated air mains system. Due to its location above the Arctic circle—Kiruna has very low winter temperatures. Freezing in the pipe line systems and low temperatures in the underground workings are therefore problems of considerable magnitude.

To overcome these troubles, it is intended to provide a decentralized air supply system. Under this scheme, heavy rock drills will be combined with separate portable compressors supplying them with hot compressed air without aftercooling. Experience so far gained, from tests and from actual drilling operations with one of these special Atlas Diesel units, has been promising. Hot compressed air is supplied from an electrically driven Atlas type CR6DV compressor fitted with rubber-tyred wheels and delivering about 335 cu. ft. (9.5 m³) of free air per hour. Type BBC 41 rock drills are mounted on the two chain feeds of the BUK 21K drilling unit. Comparison between the employment of a separate compressor and the alternative method of using air from a mains system has revealed that there are certain fundamental differences. Aftercoolers are used nowadays in most large compressor stations, enabling part of the energy consumed during compression to be recovered in the form of heat from the cooling water. On the other hand in hot air operation this heat recovery is to some extent sacrificed to improve conditions in the workings and to ensure more reliable operation of the machines. The temperature gain in the drifts has to be about 6 deg. C. more than the normal rise, which is now about 1 deg. C. but may be expected to be still smaller in future when sub-level caving has progressed further and the cold can more readily penetrate to the interior of the mine. Warm cooling water from the intercooler is also brought into the hot air supply scheme, being supplied to the rock drills for flushing purposes.

The highly energized hot air supply has a lower specific gravity than cold air at the same pressure. The air consumption expressed in cu. ft. or m³ is therefore about 30 per cent lower, so that a compressor of smaller capacity can be used. Moreover, an improvement of nearly 10 per cent in the net drilling rate has been recorded in this experimental hot air operation. This may perhaps be accounted for by the improved lubricating properties, it being difficult to find any obvious thermodynamical explanation.

Air enters the rock drills at a temperature of about 75 deg. C. The constant working pressure obtained when a separate compressor is used is of great importance in attaining the maximum net drilling rate. Pressure drops which frequently occur in large mains systems due to heavy loading peaks, freezing, pipe fractures, etc. are thereby eliminated.

Leakage is, however, a vital factor in considering com-



Atlas drilling platform type R2G.

pressed air consumption. Even in carefully maintained air piping systems leakage must be taken into account and has to be allowed for in any estimates dealing with the requirement from the piping system. As leakage is greatly reduced in hot air drilling, this method should result in a favourable power input economy.

The initial cost of a number of smaller compressors will, however, be greater than that of a single large central compressor of their total capacity. On the other hand, this is balanced by savings on the compressor installation and the piping system.

When the total capacity is divided among a large number of small units, there will naturally be greater demands on the maintenance organization. Spare compressors should be kept available, partly to ensure continuity of service in the event of breakdowns, and partly to facilitate regular overhauls after a given number of working hours.

HIGHER OVERALL PERFORMANCE

In spite of the provision of aftercoolers and moisture traps, it has proved difficult at Kiruna to remove the moisture completely from the compressed air in the piping system. This applies particularly in spring, with its warm sunny days and frosty nights. The ice formed in air receivers and pipes melts during the day, and the air becomes heavily moisture laden. When the air expands in rock drills and other pneumatic tools, condensation takes place, resulting in freezing and mist formation. Trouble of this kind does not occur in hot air drilling.

The main air drawn in by the compressors has a fairly constant relative humidity. Expansion in the tools begins at a high temperature and therefore does not lead to as low a final temperature as is obtained with air from a mains system. Moreover, the whole unit is heated. The foregoing advantages all contribute to a considerably higher overall performance. The net drilling rate increases from about 50 per cent of the total working time when drilling on mains air, to about 65 per cent when using hot air. This gain results chiefly from a reduction in rigging time and a minimum of interruptions. Visibility is good owing to the absence of mist formation. Operations of the controls, drill steel renewals and collaring can be more rapidly carried out, and the operating reliability of the whole unit is raised.

Not least important is the purely human factor. As mechanized drilling work involves little physical exertion, the miners are troubled by the low temperature in the drift when the tools are fed with cold compressed air, and the rise in temperature due to the use of hot air therefore plays a big part in the effort to raise the level of output and comfort.

The net result, according to the investigations that have been made, is an increase of 15 per cent to 20 per cent in the total footage obtained per shift. At Kiruna, with its high wages, this is of considerable economic importance. Although, unfortunately, no accurate cost-account can be prepared on the basis of the available data, it can be established that the increase in output heavily outweighs the other cost factors involved.

The experiments have thus been promising, and tests in drifting—which will take advantage of the experience gained—have begun. In this case drilling is undertaken with ordinary Atlas pneumatic pusher drills using easily transportable drilling platforms on rubber-tyred wheels. However, as the equipment has to be moved from drift to drift for each round, a compact unit is required. The drilling platform should therefore be built in with the compressor, and such a unit is, in fact, at present under construction. In caving, on the other hand, drilling is in continuous progress for long periods, and it is therefore no disadvantage for the equipment to consist of two units.

Some of the advantages of hot air drilling are, of course, largely conditioned by the cold climate and other local factors at Kiruna. It is true to say, however, that a decentralized compressed air system, together with hot air drilling, can also offer technical advantages in other mines with different conditions.

Crystal Corundum Discovery in Mozambique

A new deposit of crystal corundum has been discovered 30 miles to the south of Vila Pery, Mozambique. The deposit is described in the U.S. Bureau of Mines publication, *Mineral Trade Notes*, Vol. 40, No. 3.

Six mining claims, covering about 135 acres, have been pegged in an area of paragneiss in a region of perennial streams at an elevation of 2,500 ft. The claims are held in partnership and an American company has been requested to finance production facilities up to a maximum of £5,000.

GEOLOGICAL FORMATION

Good-quality blue crystal corundum occurs in the heavy soil mantle covering the claim area and in the valleys between the slightly undulating hills. The area has not been explored enough to determine the depth of the enriched soil, but some open pits along the roadway have disclosed a depth of at least 5 ft. Other pits have been sunk in a highly altered feldspathic dyke from which corundum crystals up to fist size have been dug. The feldspar, even though nearly completely altered, retains its crystal structure where it occurs. It appears that the paragneiss has been intruded by a number of these dykes and corundum concentration in the soil has come from the alteration of the dykes.

Reserves of crystal are far from being established. However, from the quantity of crystal recovered from the various pits and the extent of the mineralization it seems safe to estimate that a minimum of 1,000 tons of good quality material could be recovered quickly and cheaply. As exploration of the area progresses it seems probable that a considerably greater tonnage than this will be established.

PRODUCTION POTENTIAL

If the mineralized area can be increased above that which is at present held by pegging, and it is expected that this will be done, the production potential of the area can become important. In addition, as the feldspathic dykes are opened up it is highly possible that reserves of corundum *in situ* will be considerable.

This corundum deposit lies in a region of heavy rainfall in the rainy season. Perennial streams cross the area in abundance and water for operations is plentiful. The climate is good, although temperatures are high in the summer months and native labour is plentiful.

It is estimated that with an expenditure of not more than £2,500 and by using hand methods in digging, washing, and similar work, the property could be put into production at a rate of 100 tons per month. If it can be proved that reserves are large enough to warrant the expenditure, then mechanical operations can be begun. Mechanization does not appear practical or necessary at present, although this may turn out to be an important corundum area. It appears probable that at least 1,000 tons of good quality crystal can be produced during 1955.

Beneficiation of Scheelite Ore from the Sangdong Mine, Korea

The Sangdong tungsten mine, South Korea, has been a major source of dollar income in recent years but was closed down in March, 1954, through the decline in tungsten prices and owing to the fact that a sales contract with the United States Government had been terminated. One of the problems associated with the recovery at Sangdong is improved mill recoveries and studies to determine the feasibility of producing marketable tungsten concentrates by mineral dressing methods accordingly were undertaken recently by the Mineral Dressing Section of the U.S. Bureau of Mines. The studies have shown that the future of the mine may be regarded with optimism, and in the following article, condensed from U.S. Bureau of Mines *Report of Investigations 5088*, the tests to which Sangdong scheelite ore was subjected are described. The report was prepared by P. H. Floyd and F. W. Wessell, Metallurgists, Metallurgical Division, U.S. Bureau of Mines.

The Sandong Mine, Korea, was the foremost producer of tungsten concentrates in that country on two occasions, namely during part of World War II and in 1953. It was also a significant producer of bismuth concentrates. Resources are extensive and could support a 5,000-ton annual output of tungsten concentrates for many years.

Located in the eastern part of South Korea near the 37 deg. latitude, Sangdong has been a vital source of dollar income for the Republic of Korea in recent years. Its shutdown in March, 1954, came about as a result of the great decline of tungsten prices and the fact that a sales contract with the United States Government had been terminated.

In addition to establishing new markets, the problem of reopening Sangdong will be related to cost reductions and improving mill recoveries. Large quantities of offgrade scheelite concentrates were produced in the past and shipped to the United States for further beneficiation. Other low-grade concentrates and middlings have been stockpiled or discarded at the mine plant.

The problem presented here was to determine the feasibility of producing marketable tungsten concentrates by mineral-dressing methods. The consequent test work demonstrated the feasibility of a combined gravity, flotation, and magnetic-separation procedure for the production of both tungsten and bismuth concentrates from the ore. It was further demonstrated that the low-grade scheelite concentrate could be treated by a soda-ash roast-leach extraction process to make a product containing at least 60 per cent tungstic oxide.

NATURE OF ORE

A representative sample of the lot of ore submitted was examined in the petrographic laboratory, and the various products made during the test work were examined under a binocular microscope. The following minerals were found in the ore: Hornblende, chlorite, biotite, quartz, and calcite; some magnetite, pyrite, and scheelite; small amounts of molybdenite, fluorite, and apatite; and very small amounts of pyrrhotite and bismuthinite.

Exploratory concentration tests were precluded by the small amount of ore available for beneficiation. Only one test was possible; therefore, to insure satisfactory results, the ore was minutely examined and the test carefully planned in detail.

The products from the screen analysis were examined under a binocular microscope. It was observed that approximately half of the scheelite was liberated in the minus-28-mesh plus-200-mesh fraction. This observation pointed to the possibility of making a substantial recovery of a marketable grade of scheelite concentrate by tabling. If this should prove feasible, nearly half of the ore could be treated at relatively coarse sizes. The alternative to gravity treatment is treatment by flotation; this would require further grinding, which, in addition to its cost, will cause the scheelite to slime and thus make its recovery difficult.

In preparation for test work, the sample was reduced to minus-28-mesh size by staged roll crushing and the rolls used to limit the formation of fines. The sample was then hydraulically sized in a Fahrenwald-type classifier. The classifier spigot products were passed individually over the laboratory diagonal-deck shaking table. Close observation of the table operation revealed that elimination of a tailing without substantial loss of tungsten would be impossible because, as mentioned above, the scheelite was not completely liberated in the coarser sizes. The table rougher concentrates from the various spigot products were subjected individually to table cleaning operations. The tailings from the table operations were set aside for subsequent scavenger flotation treatment.

The cleaned scheelite concentrates from the gravity circuit were combined, repulped in a 500-gram laboratory cell, and floated to remove pyrite, molybdenite, and bismuthinite; the tungsten remained in the tailing. The sulphide concentrate was satisfactorily free of scheelite, and a binocular microscope showed the tailing to be virtually free of sulphide minerals; however, the sulphide concentrate was of insufficient weight for analysis.

The minus-100-mesh fraction of the scheelite concentrate was of satisfactory grade, but the oversize contained considerable amounts of amphiboles, diopside, garnet, and magnetite, all of which could be removed by magnetic separation. Accordingly, the dried 100-mesh oversize was roasted at 700 deg. C. for 15 minutes, cooled, and separated on a Stearns model B magnetic crossbelt separator at maximum intensity. Roasting was introduced into the circuit as a safety measure; it was not clearly necessary, but there was insufficient material to permit experimentation with alternate procedures.

Three products (aside from the coarse sulphide concentrate) resulted from this treatment of the tungsten table concentrate: A 100-mesh undersize and non-magnetic 100-mesh oversize, which were combined to form a final tungsten concentrate, and a magnetic 100-mesh oversize fraction, which was rejected. Three concentrates have been prepared by the application of mineral-dressing methods to this ore:

(a) A gravity concentrate containing 41.2 per cent of the total tungsten at a grade of 61.7 per cent.

(b) A flotation concentrate containing 31.3 per cent of the total tungsten at a grade of 14.4 per cent.

(c) A sulphide flotation concentrate containing 46.3 per cent of the bismuth at a grade of 11.1 per cent.

A chemical analysis of the ore showed the following components:

Assay, oz. per ton		*Analysis, per cent*				
Au	*Ag*	*WO₃*	*Bi*	*Mo*	*F*	*CaO*
0.03	0.25	10.7	0.46	0.12	12.85	37.3

A representative sample of the concentrate was examined in the petrographic laboratory and was found to consist of fluorite, calcite, scheelite, biotite, apatite, quartz, and pyrite and small amounts of molybdenite, chlorite, bismuthinite, chalcopyrite and hornblende. Under the binocular micro-

scope, it was observed that most of the scheelite had been ground finer than 400-mesh, making further gravity methods of doubtful effect.

It also was improbable that further flotation would produce a marketable grade product because of the inherent difficulty of depressing fluorite, calcite and sulphide minerals. The chemical process of roasting the ore with soda ash, followed by a water leach and the precipitation of artificial scheelite from the resulting leach solution, presented a good possibility for the treatment of this low-grade tungsten product.

BENEFICIATION TESTS

The test scheme adopted was as follows: Conversion of the scheelite in the concentrate to soluble sodium tungstate by roasting the raw material with soda ash and sodium chloride; leaching the crushed sinter with water to remove the soluble sodium tungstate formed by the roast; and precipitation of artificial scheelite from the pregnant leach solution with calcium chloride.

A series of roasts was made using the quantities of soda ash and sodium chloride as experimental variables. The quantity of soda ash was varied within the limits of two and three stoichiometric equivalents. Test data indicated that 2½ equivalents represented the smallest amount of soda ash that would satisfactorily convert the scheelite to sodium tungstate during roasting; however, the final test was conducted with three equivalents to assure maximum conversion. The method of recovering tungsten from the pregnant leach solution was determined in a preliminary investigation. The sodium tungstate solution resulting from the aqueous lixiviation of the reaction mass was treated with calcium chloride to obtain an artificial scheelite precipitate. The pregnant solution was heated and the calcium chloride solution added dropwise, with vigorous agitation, in increments of one-tenth of the stoichiometric amount required to precipitate the entire original soda ash addition. The precipitate resulting from the addition of each increment was filtered, washed, and analyzed separately to determine the characteristics of the process and to make it possible to combine the separate precipitation products to the best advantage. This preliminary work established the fact that an artificial scheelite product containing 60 per cent tungstic oxide, low in molybdenum, could be obtained.

The optimum operating conditions so established were combined into a complete beneficiation test. The flotation concentrate (200 grams) was ground with soda ash (29.4 grams) and sodium chloride (30.0 grams) until the mixture would pass a 150-mesh screen. The charge was thoroughly mixed, placed in a flat fire-clay dish, and roasted in an electric muffle furnace at 900 deg. C. for one hour. The resulting sinter was cooled and ground to pass a 65-mesh screen and water-leached for 24 hours at an average temperature of 50 deg. C. and at approximately 35 per cent solids. It is doubtful that this lixiviation would require 24 hours, but time and material did not permit an investigation of this test variable. It has been noted from other ores that have been given similar treatment that less than one hour of lixiviation time was adequate for leach extraction of the soluble sodium tungstate. After leaching was complete, the pulp was filtered and washed; the residue was dried and assayed as the leach residue and the filtrate was carried to the precipitation stage. Artificial scheelite was precipitated with calcium chloride solution.

The soda-ash roast-leach process successfully yielded an artificial scheelite product of 65.4 per cent tungsten oxide and 0.44 per cent molybdenum with 74.5 per cent tungstic oxide recovery and an artificial scheelite product of 68.3 per cent tungstic oxide and 2.4 per cent molybdenum with 20.2 per cent tungstic oxide recovery. Neither product was contaminated with bismuth or phosphorus.

CONCLUSIONS

From the test work on the Sangdong scheelite ore, the conclusions may be drawn that by crushing and grinding through 28-mesh in equipment selected to produce a minimum of fines, enough, scheelite can be liberated to warrant concentration by shaking tables. The table concentrate can be cleaned simply by sulphide flotation and magnetic separation. Further, a bismuth-bearing by-product could be made by cleaning the scheelite table concentrate and selectively floating the table tails. After proper grinding (90 to 95 per cent minus-200-mesh) a scavenger flotation operation recovered a major portion of the sulphide minerals and the remaining scheelite in two selective concentrates. The tungsten flotation concentrate was of low grade (approximately 14 per cent tungsten trioxide); however, such a concentrate is suitable for beneficiation by hydrometallurgical methods. The scheelite in the ore submitted was locked with the gangue to the extent of 50 per cent in the minus-20-mesh plus 200-mesh fraction, and 100 per cent in the plus-20 mesh fraction. The grind for flotation work demonstrated good liberation of scheelite below 200-mesh. The test work on the Sangdong low-grade scheelite concentrate indicated the feasibility of a soda-ash roast-leach extraction of sodium tungstate to precipitate an artificial scheelite product. The product, made from the first part of this calcium chloride precipitation met market specifications in both tungstic oxide content and maximum molybdenum content allowable. The subsequent precipitation products were high in molybdenum, even though the minimum grade for tungstic oxide was met.

The beneficiation work completed has demonstrated that Sangdong scheelite ore is amenable to concentration into marketable grade products.

Correspondence

SEPARATION OF COLUMBITE BY SIEVING UNIT

The Editor, *The Mining Journal*.

Sir,—With reference to Mr. T. G. Hawker's letter of July 21, regarding the above and published in your August 19 issue, we would suggest that had Mr. Hawker studied the article more closely he would have realized that the author had his facts right and that the Separator to which Mr. J. Hurst referred in the paragraph quoted, was, in fact, a Magnetic Separator and not a Sieving Machine.

In the next paragraph, Mr. J. Hurst indicates that to achieve satisfactory results (with the Magnetic Separator) it is necessary to obtain particles of equal size, and goes on to indicate how the Russell Cascade was found to be the only machine capable of doing this; other Sieving Machines failing owing to the curious form of the columbite particles which are mostly shaped like minute carrots.

We hasten to assure Mr. Hawker that we were not in any way trying to steal his Company's "thunder" or, in fact, that of any other magnetic Separator manufacturer and fully realize that for the successful sieving of columbite both types of machines are complementary.

Yours faithfully,

W. J. PIZZEY,
General Sales Manager.

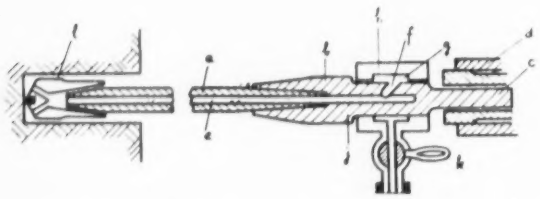
August 19, 1955.

Russell Constructions Ltd., Russell House, Adam Street, Adelphi, London, W.C.2.

MACHINERY AND EQUIPMENT

A Range of Dust Extraction Equipment

It is announced by the Consolidated Pneumatic Tool Co., Ltd., that they have entered into an agreement dating from April 22nd, 1955, to take over virtually world-wide representation for the Hemborn range of dustless dry drilling equipment. Certain Continental territories are, for the time being, excluded from the new arrangement, but immediate selling plans are being made in respect of the United Kingdom, British Dominions and many other overseas areas.



Arrangement of the Hemborn suction head.

This news comes at a time when dustless dry drilling is receiving a growing amount of attention, and it is the outcome of a great deal of investigation to find the most efficient method. The Hemborn equipment is now being adopted for all classes of percussive drilling, and forms part of the CP range of roof bolting equipment. Recent tests of the Hemborn dust extractor, carried out at the N.C.B. Research Establishment at Isleworth, have shown excellent results, and the trials with vibro-percussive drills have proved highly successful.

One of the big advantages of the Hemborn range of equipment is that it can be used with any type of drill, percussive, rotary or vibro-percussive. Special Hemborn equipment is available for deep hole drilling, and Consolidated Pneumatic have already installed Hemborn Dustless Dry Drilling equipment in a number of mining areas in the U.K.

As an example of this range of equipment, the Hemborn Suction Head takes the form of a sleeve fitting over the specially designed shank end of the drill rod. The drill steel consists of a hollow rod "a" of circular cross section sweated on to the shank end "b" and carrying a shank "c" of suitable shape and size for the percussive drill "d". The channel in the rod "e" leads through a transverse hole "f" into an annular groove "g" which is the main feature of the cylindrical sleeve or suction head "h". It is held between the front end of the drill and the collar "j," the drill steel being free to rotate within it. There is thus a free passage for dust laden air to be drawn from the bit, through the drill rod into the sleeve and past the cock "k" to the dust collector.

The bit designed for use with this apparatus is provided with holes on its face of considerably larger diameter than those used in wet drilling. There are also cutting edges along the sides of the bit which facilitate the retraction of the drill rods from inclined holes or horizontal holes through fissured strata. Any debris falling into the hole is comminuted by the rotation of the bit during extraction, and is then carried away through the hollow rod.

Aerial Survey Aids British Guiana

As part of the U.K. Government's policy to aid colonial development, the Directorate of Colonial Surveys is undertaking a further aerial survey of British Guiana, the contract for which has been awarded to Hunting Aerosurveys, Limited, a member of the only sterling area aerial survey group equipped to carry out all types of aerial survey and airborne geophysical work. This is the fourth aerial survey contract in British Guiana since the war.

New Assay Balances

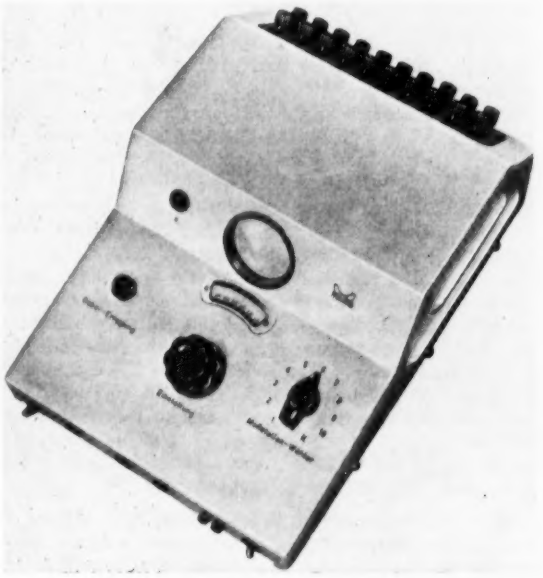
To meet the demand for a high speed assay balance, Oertling, Ltd., have designed two new balances designated Models 161 and 162. Special points concerned in the construction of these units are the efficient air damping system, which quickly brings the balance to rest, and the optically projected scale, on which the direct readings can be taken quickly and accurately.

In addition, Model 162 has a Multiweight weight-loading device which eliminates the need for weights below 1,000 assay dwts. These new features, added to the standard of performance and reliability for which Oertling assay balances are so well known, enable weighings of the greatest accuracy to be made quickly with the minimum strain on the operator. In short, these new models bring to the service of assayers the latest developments in precision balance design. Model 161, has a multiweight automatic weight loading device. This enables very high speed readings to be taken and is recommended where time is a major consideration.

Aid to Mining Research

The importance of research on rock pressure is being recognised to an ever-increasing extent within the mining industry. In this connection the Maihak Remote Control Extensometer aids in the furnishing of accurate fundamental data in respect of the behaviour of rock. The receiver is highly accurate, stable and versatile for the measurement of tensile and compressive forces, deflections, mechanical and hydraulic pressures and temperatures.

Suitable transmitting elements for use with the receiver are available for measurement of gangue filling pressures, convergency between tunnel floor and ceiling, rock pressure in horizontal and vertical drill holes as deep as fifty yards, extension and contraction of the outer skin of rock, the stress on rock stays (tensile and comprehensive forces), strength at the coal face (pile pressure), soil and rock pressure beneath foundations, pit deformation, extension and compression of shaft lining, the rock temperature and pore water pressure. Sales and Service Representatives in Great Britain and Ireland are Smail Sons and Co., Ltd.



The Maihak Extensometer.

METALS, MINERALS AND ALLOYS

Purchases up to June 30 last under the U.S. Government's buying programme for domestic tungsten, manganese, chrome, mica, beryl and columbium-tantalum were announced at the end of last week by Mr. Manshre, head of the General Services Administration.

Of the 3,000,000 s.tons units of 20lb. each of contained tungsten authorized under the buying programme, deliveries as at June 30 last totalled 1,930,028 s.ton units. With regard to manganese, 14,728,575 l.ton units had been delivered by June 30 against the authorized total of 37,000,000 l.ton units of 22.4 lb. each of contained manganese. With regard to chrome, 200,000 l.tons of ores and concentrates were authorized and at June 30, 87,833 l.tons had been delivered. Under the buying programme authorized purchases of beryl amounted to 1,500 s.tons which contrasts with the delivery of 708 s.tons at June 30. The much publicized purchasing programme for columbium-tantalum which extended to the authorization of 7,500 s.tons of contained columbium-tantalum pentoxides, deliveries at June 30, 1955, stood at approximately 5,920 s.tons. However, forward foreign commitments has resulted in the programme limitation being exceeded and thus no further purchases of foreign ore or concentrates are being made.

COPPER.—The American industry was engaged last week in establishing the new price level of 40 c. per lb. By August 24, everybody had fallen into line with Kennecott the last to do so. Some fabricators had anticipated the rise but the others fell into line with the producers with rises of anything between 3¼ and 5 c. per lb. for their products. International Nickel has also raised its domestic price from 35⅛ to 39⅛ Canadian c. per lb. With London copper prices several times breaking records in the past week and with a substantial demand from the United States evident on the London market, the American price of 40 c. began to look limp as soon as it was made. What seems clear is that the American adjustment is not going to satisfy the Chileans or attract their metal so long as the substantial gap persists between Connecticut Valley and London prices and so long as the Copper Department can exert its will on the copper companies. Reuter reports the Chilean Minister of Mines as saying that in spite of the American price increase the Chilean Government will adhere to their demand that only 35 per cent of American copper should go to the United States. What is not less clear is that however much ground may have ben lost to aluminium by sending copper to 40 c., the demand for copper is as fierce as ever. It has to be remembered that the optimism in the United States is of a 1920's quality. Capital expenditure, current and planned, is at a high level and consumers are buying and becoming indebted at an unprecedented rate. Moreover, after the bout of wage increases, consumers will have even more to spend and businesses will be more ready to make labour saving capital investments. It is true that credit in the United States has been tightened a little but not enough to curb the present spirit, and while the American retail price level remains so stable the danger of inflation cannot be adjudged serious. In the circumstances, to say that copper is going to be tight till the end of the year is almost certainly an understatement. (The recent floods in the United States have damaged brass plants—some seriously—and the Copper and Brass Warehouse Association describes the industry's position as critical. This may lead to some temporary easing of pressure on primary producers but since brass foundries are understocked they will not cut their buying much, if at all, even if the floods have forced them out of production.) What all this amounts to is that the expansion of industrial activity in Europe in the past two years and in the United States in the last nine months has outstripped the copper industry's capacity for supply. Unless a real recession is on the way a new expansion of copper production is called for.

It was therefore welcome news that a new mine at Indio Muerto, 20 miles north of Potrerillos, has been discovered by Anaconda. It is said to be at 10,000 ft.; to have as much tonnage as Toquepala (which is about 400,000 tons) and to be rather richer (Toquepala's ore is one per cent). Anaconda has blocked out the orebody that would warrant mining operations within a relatively short time and has begun an intensive drilling campaign to determine more exactly the extent of the deposits. Drilling is expected to continue for the next two years.

Anaconda has also reported that its Butte Hill property in Montana is on the threshold of the biggest expansion in its 90-year history. A large new low-grade open pit copper mine will be ready for production some time next year and the Kelly mine and shaft, the first step in the greater Butte project which started several years ago, is now running at capacity.

The Kelly mine and the Berkeley pit are expected to have a joint yield of about 90,000 tons of refined copper a year.

Anaconda is also planning a large expansion programme on the site of old high-grade deep copper mines along the top of Butte Hill. Some of these old mines are now down to 4,700 ft. and the company now proposes to erect one or two large shafts to handle daily 15,000 tons of ore each from these rich deposits.

Estimated production from the American owned plants in Chile for the second half of 1955 is 202,655 tonnes. Production was 211,010 in the first half, making a total of 430,665 tonnes in the full year. Ministry of Mines Sources have suggested that of the third quarter output 60,000 tons will be sold to the United States at 40 c. per lb. and an approximately equal amount will go to Europe at prices ranging between 43 and 47 c. per lb.

Reuter reports a new copper-nickel discovery near Delahey Lake, Pontiac County, in Quebec. There is no indication to the volume of the deposit but it is said that values of the order of two per cent copper have been picked up over appreciable widths for a length of over 3,000 ft.

From Rhodesia it is reported that the European Mineworkers' Union has offered to postpone for three years its insistance on a clear acceptance by R.S.T. of the pledge given by Anglo American not to transfer jobs to Africans without the consent of white workers. The postponement is said to be conditional on R.S.T. giving an undertaking during this period not to go beyond the schedule of jobs to be handed over to Africans under the Anglo American agreement. However, later messages attributed to the Union's general secretary the view that the European Union is determined to insist on the guarantee. The Secretary is also reported as saying that this position has been sympathetically endorsed by the Federal Trade Union Council which is now asking all member unions to give their formal approval and support of the European miners. The Executive of the Rhodesia Railway Workers' Union has recommended financial assistance for the European miners, in the event of a strike at R.S.T. mines. The North Rhodesian African Mineworkers' Union has lodged a new wage claim for a daily increase of 6s. 8d. It is understood that negotiations have been postponed until early September.

LEAD.—Lead has enjoyed a good demand in the past week on the basis of 15 c. per lb. New York. A strong market for the metal seems assured for some time to come and, as with zinc, there is talk of a further price rise. However, there is a good stock of ores and concentrates awaiting refining now that the American Smelting and Refining strikes are over and, since supplies of the metal were never desperately tight, the price rise may have to be delayed. Unlike zinc, lead's statistical recovery has been achieved alongside a substantial fall in lead imports. Refined lead imports in the first six months of the year were 115,102 tons against 140,624 in the first six months of 1954.

TIN.—Tin has been a fairly steady market in New York; a slight easing in the early part of the week was followed by a firmer trend and prices have fluctuated roughly between 96¼ and 96¾ c. per lb. for spot Straits metal. There is now a fairly general conviction that, until a change is made in American tin stockpiling policy, world supply and demand will be in balance, and perhaps a rather high balance. With the American economy still booming away Americans are naturally nervous of the possibility that strikes in the Far East will upset this delicate balance and have perhaps paid a rather exaggerated attention to the latest labour dispute in Singapore. In the first half of 1955 primary tin consumption was 30,000 tons, 7 per cent up on the first half of 1954; use of secondary tin was up by 16 per cent. This growth in consumption may be even higher in the second half.

The President of the Miners' Association of Selangor, Negri Sembilan and Pahang, Mr. H. S. Lee, has given the view that the International Tin Agreement would be unlikely to come into effect before April of next year. Indonesia, he thought would not ratify until after the general election next month; this is probably right but it will still remain to be seen whether the elections produce a government with an adequate majority and, if so, what "colour" the government will have. It should not be forgotten that there are large parts of Indonesia where the writ of the Administration scarcely runs at all and any plans at any time are likely to be thrown overboard in favour of simply maintaining law and order. It should not be forgotten either that the coming general election is the first one to be held in Indonesia and it is difficult in the extreme to forecast its result.

According to International Tin Study Group's statistics, mine production of tin in concentrates during July was 5,245 tons in Malaya, 3,420 tons in Indonesia and 1,339 tons in the Belgian Congo.

ZINC.—There is still a very active demand for all grades of zinc in the United States with galvanizers wanting large amounts of prime western grades and special high grade zinc, remaining exceptionally tight. Given these conditions, and given the general view that demand is likely to be at least as good as throughout the remainder of the year there has naturally been much speculation on the possibility of zinc advancing on the back of the copper rise. Zinc has already established a useful recovery of 12¼ c. per lb. East St. Louis but the zinc producers have never concealed their hope of a yet better price. Now that the year's wage increases are out of the way there should be less inhibition about a further rise. The only deterrent must be the inevitable rise of imports; imports of zinc have already risen in the first half of the year to 85,692 tons compared with 74,077 in the same period of 1954. New Jersey Zinc Company has started development of the Flat Gap property recently acquired at Treadway, Tennessee. It plans to start sinking next month the first of two shafts to the lead free zinc sulphide ore-body. A mill will be erected to treat 2,000 tons of zinc ore daily.

ALUMINIUM.—A new monthly record in primary aluminium production was established in the U.S.A. in July when the industry's output totalled 132,699 s.tons. This figure brings the total output for the first seven months of this year to 892,535 s.tons, an increase of nearly 51,000 s.tons over the 841,561 s.tons produced during the comparable period a year ago.

Reflecting the potential threat of aluminium as a substitute for copper, is the announcement that the Anaconda Aluminium Company formally became the fourth aluminium producer in the U.S. when it dedicated a 65,000,000 dollar primary aluminium factory at Columbia Falls, Montana, earlier this month. Anaconda Aluminium is the first new company to enter the field of aluminium production in the U.S. since 1946. The factory is expected to reach its capacity rate of 60,000 s.tons annually by the beginning of next year.

However, another copper company, the Revere Copper and Brass Company, has requested O.D.M. to authorize federal tax benefits to help finance a proposed aluminium plant costing nearly $53,000,000 at Wenatchee, Washington. Details of the proposed plant have not been given but it is believed that the plant would be capable of producing about 60,000 tons of aluminium a year.

A programme to expand the Wenatchee Works, Washington, of the Aluminium Company of America by the immediate addition of aluminium smelting equipment was announced at the end of last week. The project will involve the installation of additional pots in each potline at a cost of some $2,000,000 which will enable the capacity to be raised to about 100,000 tons annually. Alcoa has also announced a $19,000,000 expansion of aluminium foil production facilities at its Davenport, Iowa, and Alcoa, Tennessee plants which will enable the company to produce an additional 16,000 s.tons of foil annually. The major portion of the finance is earmarked for the Davenport plant.

After five years' negotiations and study the Gold Coast does not appear to be any nearer to realizing its aim of harnessing the Volta River to establish an aluminium industry. However last week in Geneva Dr. W. A. Lewis in an interview said that the Aluminium Company of Canada and the British and Gold Coast Governments were attempting to reach agreement for the establishment of this $450,000,000 project. Dr. Lewis said that a draft agreement had been signed in 1953 but following the financial failure of the government-backed groundnut scheme it was decided to re-assess the Volta River project with an eye to the investment involved. The Preparatory Commission is expected to report on the project by the end of this year and if it is favourable, negotiations, Dr. Lewis said, would begin next spring on the final agreement.

TITANIUM.—"An unnecessarily pessimistic attitude has been taken by certain U.S. government officials on the titanium production programme" according to a Senate Interior Sub-Committee report prepared by the staff of a special sub-committee on minerals, materials and fuel economics.

Senator James Murray, the leader of the interior sub-committee, stated that discouragement and pessimism regarding the substantial use of titanium in defence production was unfounded and that a break through which could greatly accelerate demand was closer to realization than had been supposed.

The London Metal Market

(From Our Metal Exchange Correspondent)

There was an increase in the U.K. copper stocks last week of nearly 1,000 tons and as a consequence the backwardation on the London market narrowed to about £7 per ton, but there has been no easing in the price level which in fact touched the record of £380 for "cash" on Friday last. It appears that Continental consumers are having to come into the market and there is a fair demand at high prices, and the supply position both here and in the United States remains tight for electrolytic copper wirebars for early delivery.

Tin has been an uninteresting market although fairly steady. A general strike is now hinted at in Singapore, and should this materialize shipments from that quarter may be interrupted. It is considered unlikely that Indonesia will ratify the International Tin Agreement until after the General Election next month, and that the agreement will not become operative before next April. On Thursday morning the Eastern price was equivalent to £ 761¼ per ton c.i.f. Europe.

The demand for lead in this country is improving, whilst in the U.S. it is very good. The market has a firm appearance.

There is quite a good demand for zinc here, on the Continent, and in the U.S. consumers seem to be buying steadily. Closing prices and turnovers are in the following table :—

	August 18		August 25	
	Buyers	*Sellers*	*Buyers*	*Sellers*
Copper				
Cash	£374	£376	£371	£371¼
Three months	£361	£362	£364½	£365
Settlement	£376		£371½	
Week's turnover	3,300 tons		3,700 tons	
Tin				
Cash	£751	£752	£747	£748
Three months	£748	£749	£747	£748
Settlement	£752		£748	
Week's turnover	430 tons		350 tons	
Lead				
Current half month	£106¼	£106½	£106½	£107
Three months	£105½	£106	£105½	£106
Week's turnover	2,075 tons		1,850 tons	
Zinc				
Current half month	£89	£89½	£89⅜	£89⅝
Three months	£89	£89¼	£89⅜	£89½
Week's turnover	3,725 tons		1,925 tons	

OTHER LONDON PRICES — AUGUST 25

METALS

Aluminium, 99.5%, £171 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £210 per ton
Crude (70%) £200 per ton
Ore (60% basis) 23s. 6d./24s. 6d. nom. per unit, c.i.f.
Bismuth (min. 1 ton lots) 16s. lb.
Cadmium 11s. 6d.
Chromium, 6s. 11d./7s. 4d. lb.
Cobalt, 21s. lb.
Gold, 251s. 4d.
Iridium, £30 oz. nom.
Manganese Metal (96%-98%) £269 according to quantity
Magnesium, 2s. 4d. lb.
Nickel, 99.5% (home trade) £519 per ton
Osmium, £24/27 oz. nom.
Osmiridium, £40 oz. nom.
Palladium, £7 0s./£7 10s. oz.
Platinum U.K. and Empire Refined £29 oz. Imported £31 oz.
Rhodium, £40
Ruthenium, £17 oz.
Quicksilver, £90/£95 ex-warehouse
Selenium, 43s. nom. per lb.
Silver, 78⅞d. f.oz. spot and 78⅝d. f'd
Tellurium, 15s./16s. lb.

ORES, ALLOYS, ETC.

Bismuth .. .. 50% 7s. 3d. lb. c.i.f.
40% 6s. 3d. lb. c.i.f.

Chrome Ore—
Rhodesian Metallurgical (semi-friable) 48% £13 per ton c.i.f.
" Refractory 45% .. £13 per ton c.i.f.
" Smalls 42% .. £10 2s. 6d. per ton c.i.f.
Magnesite, ground calcined .. £26-£27 d/d
Magnesite, Raw .. .. £10-£11 d/d
Molybdenite (85% basis) .. 105s. 0d.-108s. 0d. per unit c.i.f.
Wolfram and Scheelite (65%) .. 254s./257s. c.i.f.
Tungsten Metal Powder (98% Min. W.) .. 20s. 6d. nom. per lb. (home)
Ferro-tungsten (80%-85%) .. 17s. 6d. nom. per lb. (home)
Carbide, 4-cwt. lots .. .. £37 6s. 3d. d/d per ton
Ferro-manganese, home .. £54 10s. 0d. per ton
Manganese Ore Indian c.i.f. Europe (46%-48%) basis 100s. freight. .. .. .. 81d./84d. per unit
Manganese Ore (38%-40%) .. 66d./68d. per unit
Brass Wire .. .. 3s. 4½d. per lb. basis
Brass Tubes, solid drawn .. 2s. 10¾d. per lb. basis

THE MINING MARKETS

(By Our Stock Exchange Correspondent)

Gilt-edged and industrial shares were heavily marked down during the week. As an example of this, the Treasury permitted the flotation of the Uganda 4¼% Loan 1968/73 at a price of 97%; this yields 5%. The fall, while partly attributable to the government's squeeze on credit, was also due to anxiety concerning the possible effect of further wage demands and strikes on the U.K. economy.

Mining markets were no exception to the general rule. Prices everywhere were lower. Among South African finance houses, only Johnnies and Consolidated Goldfields recorded an improvement over the week and even these finished below the best.

Among individual Rand mines, there was some continental demand for one or two of the older producers. Certain mines have shown most encouraging increases in profits over 1954 due principally to the improved supply of native labour and consequent reduction in mining costs. Geduld and Simmer and Jack were the principal beneficiaries although there was also some quiet buying of Durban Deep. Hartebeestfontein at first went ahead on further consideration of the excellent initial results and the official announcement that the company will be a uranium producer. The shares, however, failed to hold the improvement.

In the Orange Free State section, Free State Saaiplaas changed hands fully paid at 17s. Freddies lost last week's gains. No official statement was forthcoming concerning the rumours of a new area on the Far West Rand. Elsewhere, prices generally declined, following the overall trend, but there was some demand from Johannesburg for Merriespruit.

West African gold shares were all marked down the turn in an idle market. The one exception was Ashanti which fell sharply on reported selling by a large holder.

In the West Australian market, the increased distribution of 25% as against 20% by Mount Morgan caused a rise in the share price and there was a sympathetic upward adjustment in Lake View and Star.

In the miscellaneous section, Indian mines went ahead despite the labour strike on the properties. Globe and Phoenix were also a strong feature.

Among diamond shares, prices of the leading mines tended to drift although platinums were higher following the increased dividends.

The higher price of copper, which touched £380 a ton, brought in buyers from New York and Paris in market short of stock. Most of the leading producers went ahead strongly, Tanks being outstanding in this respect, as were also Rhokana. Chartered were a popular feature, the shares at one time during the week having been as low as 71s. 6d. following the appearance of a large seller in the market.

Eastern tins were mainly easier despite the high price of the metal. Ayer Hitam propose offering to stockholders two new shares for every three held at a price of 22s. 6d. It is also intended to allow applications for excess shares. The price remained unchanged after the news. In the Nigerian market, prices of the smaller producers were mainly lower but Amalgamated Tin and London Tin both went ahead. British Tin Investment were marked down sharply due to the fall in equity prices.

Among lead/zinc shares, changes were erratic although some of the leading Barriers recorded substantial setbacks.

In the miscellaneous base metal market, Central Provinces Manganese were down following news of the Canadian manganese project. Consolidated Murchison rose sharply due to the higher American price for antimony. Turner and Newall recorded the fall in U.K. industrials.

Canadian shares were erratic although the market closed firmer due to the improvement on Wall Street. Favourable press comment drawing attention to the substantial copper production by International Nickel and the improvement in the returns from the company caused a sharp gain in these shares.

Finance	Price Aug. 24	+ or − on week
African & European	3⅜	
Anglo American Corpn.	8½	⅛
Anglo-French	22/-	-6d
Anglo Transvaal Consol.	26/3	
Central Mining (£1 shrs.)	47/3	-1/-
Consolidated Goldfields	62/6	+6d
Consol. Mines Selection	40/7½	-1/10½
East Rand Consols	2/-	
General Mining	4⅛	-⅛
H.E. Prop.	8/9	-1¼d
Johnnies	44/6	+1½d
Rand Mines	3⅜	
Rand Selection	43/1½	-7½d
Union Corporation	48/-	-1/-
Vereeniging Estates	4⅛	
Writs	43/9	-7½d
West Wits	39/3	-3d
Rand Gold		
Blyvoors	27/3	-3d
Brakpan	7/-	
Buffelsfontein	39/3	-1/-
City Deep	12/3	-4½d
Consol. Main Reef	22/6	-7½d
Crown	2½	-⅛
Daggas	2⅜	-⅛
Dominion Reefs	34/4½	-1/7½
Doornfontein	26/6	-6d
Durban Deep	35/-	+7½d
E. Champs	6/-	-3d
E. Daggas	9/9	-3d
E. Geduld (4s. units)	31/-	-6d
E. Rand Props.	3½	-½
Geduld	4⅛	+⅛
Govt. Areas	7/3	-3d
Grootvlei	21/9	-9d
Hartebeestfontein	38/6	-6d
Libanon	8/-	-4½d
Luipaards Vlei	20/9	-3d
Marievale	21/3	
New Kleinfontein	7/-	-6d
New Pioneer	12/9	-6d
Randfontein	58/6	-9d
Robinson Deep	18/-	
Rose Deep	10/6	+3d
Simmer & Jack	4/4½	+4½d
S.A. Lands	21/10½	-1/3
Springs	2/10½	+1½d
Stilfontein	27/-	-6d
Sub Nigel	35/7½	-1/3
Vaal Reefs	31/9	-1/-
Van Dyk	3/3	
Venterspost	13/9	-3d
Vlakfontein	17/-	-6d
Vogelstruisbult	31/3	
West Driefontein	5½	-⅛
Rand Gold contd.		
W. Rand Consolidated	43/9	-1/3
Western Reefs	38/1½	-1/10½
O.F.S. Gold		
Freddies	8/6	-10½d
Freddies Consolidated	4/6	-7½d
F.S. Geduld	4⅜	+⅛
Geoffries	15/-	-1/3
Harmony	31/-	-1/6
Loraine	6/3	-1½d
Lydenburg Estates	17/6	-7½d
Merriespruit	9/9	+6d
Middle Wits	14/-	-1/-
Ofsits	65/-	-3/-
President Brand	70/7½	-1/3
President Steyn	37/6	-1/-
St. Helena	30/-	-1/3
Virginia Ord.	12/6	-6d
Welkom	19/6	-9d
Western Holdings	4⅜	+⅛
West African Gold		
Amalgamated Banket	2/-	-1½d
Ariston	6/-	-1½d
Ashanti	21/9	-1/3
Bibiani	4/3	-3d
Bremang	1/4½	-1½d
G.C. Main Reef	2/9	-3d
Kononga	2/9	-1½d
Lyndhurst Deep	1/3	-1½d
Marlu	1/4½	
Taquah	2/-	-3d
Western Selection	9/-	-4½d
Australian Gold		
Gold Mines of Kalgoorlie	13/3	
Great Boulder Prop.	10/6	-1½d
Lake View & Star	19/3	+9d
Mount Morgan	22/9	+6d
North Kalgurli	6/9	
Sons of Gwalia	4/3	
Western Mining	9/-	
Miscellaneous Gold		
Cam & Motor	8/7½	
Champion Reef	4/6	+4½d
Falcon Mines	6/10½	-1½d
Globe & Phoenix	25/6	+1/-
G.F. Rhodesian	6/6	-1½d
Motapa	1/4½	
Mysore	3/1½	+1½d
Nundydroog	7/3	+1½d
Ooregum	4/3	
St. John d'El Rey	15/-	-6d
Zams	56/3	+7½d
Diamonds and Platinum		
Anglo American Inv.	9¼	-⅛
Casts	28/9	-1/-
Cons. Diam. of S.W.A.	7	
De Beers Defd. Bearer	6¼	-⅛
De Beers Pfd. Bearer	1⅛	-⅛
Pots Platinum	10/-	+1½d
Waterval	17/3	+9d
Copper		
Bancroft	41/-	-6d
Chartered	74/6	+2/-
Esperanza	3/9	-3d
Messina	9⅛	+⅛
Nchanga	15⅛	+⅛
Rhod. Anglo-American	6⅛	+⅛
Rhod. Katanga	21/-	-4½d
Rhodesian Selection	47/1½	+10½d
Rhokana	49	+4½
Rio Tinto	3⅜	-⅛
Roan Antelope	29/-	+7½d
Selection Trust	4⅛	-⅛
Tanks	9⅛	+⅛
Tharsis Sulphur Br.	6¼	-⅛
Tin (Eastern)		
Ayer Hitam	30/-	
Gopeng	9/1¼	-3d
Hongkong	7/6	+1½d
Ipoh	22/-	-9d
Kamunting	9/-	+1½d
Kepong Dredging	3/6	-1½d
Kinta Tin Mines	15/-	-3d
Malayan Dredging	9/3	-3d
Pahang	13/1½	-3d
Pengkalen	11/10½	+4½d
Petaling	10/6 xD	-1½d
Rambutan	19/- xD	-6d
Siamese Tin	7/10½	-9d
Southern Kinta	19/3	-1½d
S. Malayan	8/7½	+6d
S. Tronoh	8/3	+1½d
Sungei Kinta	14/3	
Tekka Taiping	7/9	-4½d
Tronoh	8/10½	+1½d
Tin (Nigerian and Miscellaneous)		
Amalgamated Tin	13/-	+1½d
Beralt Tin	36/6	-3d
Bisichi	5/9 xD	-3d
British Tin Inv.	22/-	-2/7½
Ex-Lands Nigeria	2/3	-3d
Geevor Tin	14/6 xD	-9d
Tin (Nigerian and Miscellaneous) contd.		
Gold & Base Metal	1/10½ xD	-1½d
Jantar Nigeria	6/10½	-1½d
Jos Tin Area	14/9	
Kaduna Prospectors	2/1½	
Kaduna Syndicate	3/-	+1½d
London Tin	9/9	+4½d
United Tin	2/-	-3d
Silver, Lead, Zinc		
Broken Hill South	56/-	+6d
Burma Mines	2/6	
Consol. Zinc	51/-	-2/10½
Lake George	12/-	-4½d
Mount Isa	58/-	-1/6
New Broken Hill	38/6	-2/4½
North Broken Hill	76/6	+3d
Rhodesian Broken Hill	13/6	
San Francisco Mines	22/6	-6d
Uruwira	7/-	-1½d
Miscellaneous Base Metals and Coal		
Amal. Collieries of S.A.	50/6	+3d
Associated Manganese	34/7½	+1½d
Cape Asbestos	10/1½	-3d
C.P. Manganese	35/-	-1/6
Consol. Murchison	56/10½	+3/9
Natal Navigation	2⅜	
Turner & Newall	104/-	-3/6
Wankie	17/6	-4½d
Witbank Colliery	4	
Canadian Mines		
Dome	$29	
Hollinger	$42½	-¼
Hudson Bay Mining	$122½	-2½
International Nickel	$146½	+3½
Mining Corpn. of Canada	£8½	+⅛
Noranda	$107	
Quemont	£9½	+⅛
Yukon	4/3	
Oil		
British Petroleum	5⅛	-⅛
Apex	34/6	+6d
Attock	40/-	-2/-
Burmah	3⅛	-⅛
Canadian Eagle	63/9	-6d
Mexican Eagle	22/3	-3d
Shell	7	+⅛
Trinidad Leasehold	39/-	-1/-
T.P.D.	24/-	-6d
Ultramar	28/6	-9d

COMPANY NEWS AND VIEWS

Harties to Produce Uranium

It has been announced by the Hartebeestfontein Gold Mining Company that by arrangement with the A.E.B. a plant with treatment capacity of 100,000 tons a month will be erected at the property for the extraction of uranium from gold residue slimes.

As for other uranium producers in the Union of South Africa, the contract under which uranium will be sold will run for a period of ten years. In the case of Harties this will not become operative until Jan 1, 1957, although construction work at the mine is to start immediately. The price payable for uranium produced will be related to production cost on a basis which will provide for the redemption of the plants capital cost plus interest—to be provided by way of loans from the A.E.B.—together with a reasonable margin of profit on the capital investment.

Harties is the most recent Far Western Rand mine to reach production after a period of opening up which established a post-war record in South African mining history by taking only two-and-a-half-years. Trial milling operations started early in May this year and the first full month of production during July produced an excellent initial working profit of £57,583. This was achieved by milling at the large initial rate of 44,000 tons with a mill grade of 6.7 dwt. per ton. It is the company's intention soon to mill 50,000 tons of ore a month and later to expand to 75,000 tons. It would, however, be surprising if this proved to be the ultimate limit and the indications are that most investors envisage something in the region of 100,000 tons.

Geevor's Profits Boosted by Sales of Flotation Residues

As foreshadowed last year by Mr. George W. Simms, chairman and managing director of Geevor Tin Mines, the cornish producer, sales of the greater part of accumulated low-grade copper concentrates in the form of flotation residues brought in a total of £50,868. This considerably increased the revenue earned by the company during the year ended March 31, 1955. Proceeds from sales of tin at £265,715 were little changed and compared with £256,787.

Year to Mar. 31	*Tons Milled*	*Black Tin per ton*	*Black Tin produced**	*Per Ton Ore Av. Value*	*Ore Cost*	*Ore Reserves*
	(000)	(lb.)	(tons)	£ s.	£ s.	(tons)
1955	54.9	25.9	634.7	5 5	3 15	180,252
1954	54.9	27.8	682.3	5 0	3 17	180,837

* 65 per cent Sn. (dry weight).
N.B. Development during the year amounted to 6,430 ft. (1954—5,864 ft.)

Dividends on the company's issued ordinary capital of £103,200 in stock units of 5s. were increased to 45 per cent from the previous figure of 35 per cent.

Year to Mar. 31	*Total Revenue*	*Taxation*	*Net Profit*	*Dividends*	*To Reserve*	*Carry Forward†*
	£	£	£	£	£	£
1955	352,717*	51,736	57,970	26,316	30,000	10,429
1954	291,161	16,466	36,608	19,866	10,000	10,840

* Includes £50,868 from the sale of flotation residues.
† After £2,065 written off. (1954—£5,457.)

An interesting part of the chairman's address in respect of the past financial year concerned the new electric hoist which has been installed at the mine. This piece of equipment, manufactured by The British Thomson-Houston company was brought into commission on August 19, 1954, and is working satisfactorily both as regards performance and economy.

Although there would appear to be a small proportion of unsold accumulated copper concentrates still left at the mine, it is naturally most unlikely that the contribution to total revenue from this source in respect of the current financial year will be of great importance. A falling off from the past financial year's exceptionally high revenue must therefore be anticipated. Yet, production figures so far published show that a total of 221 tons of black tin have been produced during the first four months of the year ending March 31, 1955, as compared with 217 tons during the previous corresponding period. And in view of the present steady price for tin together with its favourable statistical outlook, prospects for the current year's earnings look fairly good. As things stand at the moment therefore the likelihood of a 45 per cent dividend being maintained appears hopeful.

In view of the present yield of about 15 per cent obtainable on Geevor 5s. shares at their present price of around 15s. the difficulties facing U.K. mining companies seems to have been somewhat over discounted. For those whose investment activities are partly confined to U.K. securities—at present on so low a yield basis—Geevor would provide a useful home based sweetener.

Mazapil Copper's Better Year

Group trading profit — after meeting exchange losses from the Mexican peso devaluation relieved by £13,847 from exchange fluctuation reserve — made by the Mazapil Copper Company during the year ending December 31, 1954 rose to £51,294 from £8,760. After the addition of £43,576 in respect of Mexican production and export tax rebates total revenue was vastly improved from that of the previous year. Besides the stimulus to earnings gained from devaluation, a higher production of copper concentrates contributed to these very much better results.

Year to Dec. 31	*Total Revenue*	*Expenses**	*Taxation*	*Net Profit*	*To Reserve*	*Carry Forward*
	£	£	£	£	£	£
1954	94,891	30,377	25,927	31,597	50,000	6,778
1953	8,974	29,415	773	DR24,912	nil	25,225†

* Taking into account £25,000 written off fixed assets in respect of both 1954 and 1953.
† After transferring £100,000 from development reserve and writing off £55,928.

At the company's copper smelter a total of 96,862 tons was treated during the past financial year yielding 6,896 tons of copper matte with an average copper content of about 37 per cent. This compares with a total of 121,123 tons during 1953 and 8,738 tons of matte containing about 33 per cent copper. Operations in this department proceeded normally and the fall in throughput from the previous year's level was due to the fact that it was found more profitable to confine smelting to one furnace as opposed to operations during the first half of 1953 for which two furnaces were utilized.

Flotation mill operations resulted in the treatment of 83,865 tons from which 5,626 tons of concentrates were recovered. During the previous year the mill treated 59,215 tons yielding 5,376 tons of copper concentrate.

Although there was a small increase in the price of lead during 1954 it was not sufficient to justify a reopening of the company's lead smelter. Mining operations in lead - zinc areas were therefore confined to the extraction of a small quantity of oxide ore amounting to 2,353 tons of sufficiently high grade to despatch direct to customs smelters. During the preceding year the lead smelter treated about 12,164 tons before its closure in June 1953. From this tonnage 1,040 tons of lead bullion were recovered besides small amounts of silver and copper.

Mr. Thomas P. Berington is chairman, meeting, London, September 15.

South Bukeru Views Columbite Future With Uncertainty

Production of columbite by South Bukeru Areas, the Nigerian producer, during the year ended December 31, 1954, reached a total of 8.79 tons, as compared with 3.5 tons during the previous year, and it was this which was mainly responsible for the company's greater profits. A total of £20,294 was, in fact, earned from this source, as compared with £7,742. On the other hand, tin ore output fell slightly to 74¾ tons from 83¼ tons although the higher price received left revenue from this product largely unchanged at £39,392 as against £38,602 in respect of the preceding year.

Year to Dec. 31	*Total* Revenue*	*Taxation*	*Net Profit*	*Dividends*	*To Reserve*	*Carry Forward†*
	£	£	£	£	£	£
1954	59,986	5,350	2,604	4,584	2,500	2,890
1953	47,180	2,200	989	2,292	Nil	3,319

* Before deducting Nigerian and other expenditure of £49,315 (1953—£41,318).
† After transfer from reserves of £4,000 (1953—Nil.)

Dividends on the issued ordinary capital of £25,001 in shares of 2s. were increased to 33⅓ per cent from 16⅔ per cent.

In his statement to shareholders Mr. M. W. Parish, the chairman, said that while the company had hoped to pay a final dividend in respect of the past financial year in addition to the "interim" distribution of 33⅓ per cent, this hope was frustrated by the news last May that the U.S.A. had withdrawn from direct purchasing activities in the columbite market. As the company had expected the stockpiling programme to continue until the end of 1956, its cessation had constituted a severe blow. It was, at the present time, Mr. Parish continued, quite impossible to sell the columbite at anything like an economic price. Nevertheless, he believed that in due course the position would right itself but considered that under the present circumstances the company's resources should be conserved.

Speaking of the future Mr. Parish stated that it would be unwise to make any final decision until the columbite position had been clarified. Every effort would be made to press on with the production of tin while columbite output would be held up until the future could be better assessed. Meeting, London, September 26.

R.S.T. Paris Quotation

An agency message reports that Rhodesian Selection Trust Shares will be introduced on the Courtiers market of the Paris Stock Exchange sometime next week.

Union and Waterval Change Financial Year Ends

Those who have been concerned with the confusing task of relating the financial results of Rustenberg Platinum Mines to those of its holding companies will greatly welcome the change in the financial year end of Union Platinum Mining, and Waterval (Rustenberg) Platinum Mining Companies to August 31, from June 30. This synchronization of both operating and holding companies' financial years is, however, to be made for administrative convenience only and will have no effect on the declaration or payment of dividends.

In order to implement the change, annual reports and accounts for the current year will run for a period of fourteen months from July 1, 1954 to August 31, 1955. A statement detailing past and present years' dividend payments has been despatched to shareholders of both the union and Waterval companies. These schedules, while showing the distribution position clearly, include the statement that no departure will take place from the previous practice of paying two-yearly dividends in February and August respectively.

Powell Duffryn's Rise in Profits

Consolidated trading profits for the year ended March 31, 1955, earned by Powell Duffryn after deducting interest on debenture stock, directors' remuneration and profits attributable to outside shareholders moved up to £2,034,747 from £1,810,362 during the previous year. Included in these figures was interim income under the Coal Industry Nationalization Act amounting to £37,742, as compared with £385,011 and interest, before deduction of income tax on 5 per cent loan stock of Vacuum Oil Company to date of sale of £181,250 (nil). In addition, a total of £25,000 (£80,000) was transferred from taxation reserves.

Taxation absorbed £1,192,936 as against £1,032,967 and consolidated net profit was increased to £841,811 from £777,395. The sum of £1,915,488 (£2,409,536) remained to be carried forward.

With the recommendation of a final dividend of 10 per cent, total distribution in respect of the year ended March 31, 1955, has been brought up to the equivalent of 16 per cent on the present 9,660,471 ordinary shares of 10s.

Marlu To Make First Distribution Of 9d.

A first distribution of 9d. per unit by way of return of capital is to be made to shareholders of Marlu Gold Mining Areas.

At the annual meeting of the company held last May a resolution for the company's voluntary liquidation was passed unanimously. So far the liquidators have been able to effect certain sales of plant and every effort is being made to dispose of remaining equipment to the best advantage.

Amalgamated Anthracite Doubles Dividend

The recommendation of a 6 per cent dividend by Amalgamated Anthracite Holdings has raised the company's total distribution for the twelve months ended December 31, 1954, to a level double that of the previous year. It will be recalled that a 3 per cent payment was made for 1953 (following a capital re-organisation scheme) and represented the first ordinary dividend in recent years.

Group Trading profits advanced to £605,857 from £592,638 but after taxation of £241,037 (£188,887) net profits declined to £207,873 from £231,819. Mr. J. Waddell is chairman.

DIVIDENDS

Aluminium Ltd. 55 c. (September 5)
Consolidated Mines Selection 1s. *i* (September 1)
Johannesburg Consolidated Investment 15% (September 23)
Kent (F.M.S.) Tin 10% *i* (September 14)
Zaaiplaats Tin Mining 20% (September 10)

i interim

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INDIAN COPPER CORPORATION LIMITED

The Annual General Meeting of this Company which was to have been held at the Royal Exchange Hall, Royal Exchange, Calcutta, on August 17, 1955, at 11.30 a.m., owing to the lack of a quorum has, in accordance with Article 67 of the Articles of Association, been adjourned until August 31, 1955, at the same place and at the same time.

By Order of the Board,
G. H. WARD,
London Secretary.

49 Moorgate, London, E.C.2.
August 22, 1955.

SURVEYOR required by Mining Company in British West Africa. Tours of service 12 to 18 months followed by leave with full pay. Fully furnished bungalow provided. Also free fuel, light, water and reasonable medical attention. Salary according to experience. Free passages for wife after qualifying period. Write stating age, experience, qualifications, etc., to Box 295, c/o Dawsons, 129 Cannon Street, London, E.C.4.

MINE SUPERINTENDENT. Applications are invited by a Singapore Company from fully qualified Mining Engineers for the position of Mine Superintendent on a newly-equipped lode tin mine in Siam. The scope of the post as at present envisaged would extend to the whole of the technical operations on the mine under the control of the General Superintendent who would be responsible for administrative matters.

Applicants should be between the ages of 35 and 45 years and possess a University degree or School of Mines diploma in Mining.

Salary would be dependent on qualifications and experience but to a suitable man would be not less than the equivalent in Malayan dollars ($1 = 2/4 stg.) of £2,100 per annum, in addition to which there are variable allowances at present equivalent to about £30 per month. A free furnished bungalow would be provided and there is a Provident Fund to which both employee and employer contribute 10 per cent of salary. Initial contract would be for three years with passages paid and 4½ months' leave on full pay on expiry.

Applications with full personal particulars, technical qualifications and experience to Box No. 572.

GAMBIAN MINERALS LIMITED
(a subsidiary of British Titan Products Company, Ltd.)
requires for a new mining project in The Gambia still at the construction stage, an

ASSISTANT MINING ENGINEER/SHIFT BOSS to assist initially in the construction and lay out of a suface mine using excavating equipment and later act as a Shift Boss during operations.

A MILLING ASSISTANT/SHIFT BOSS to assist initially in the construction of a Dry Mill using electrical mineral dressing equipment and later act as Shift Boss during operations.

For both of the above posts about four years' field experience is required. Candidates should be about 25-30 years of age and graduates of recognised mining schools. Salary range £1,000-£1,500 depending on age and/or experience.

Free furnished accommodation and medical services are available. 18 month's tours followed by 4 months' home leaves. Wife's and children's allowances. Free passages out and back each tour with initial kit allowance. There is a Staff Superannuation Scheme and non-contributory Life Assurance Scheme.

Application Forms may be obtained from the Personnel Manager, British Titan Products Company, Limited, Coppergate, York, quoting reference S. 18. J.

MINE RETURNS

WEST AFRICAN GOLD

Company	June, 1955			Months since year end	Current Financial Year Total to date			Last Financial Year Total to date		
	Tons (000)	Yield (oz.)	Profit (£000)		Tons (000)	Yield (oz.)	Profit (£000)	Tons (000)	Yield (oz.)	Profit (£000)
Amal. Banket	71·3	10,758	16·5	9	730·2	112,308	282·7	615·5	98,393	138·0
Ariston Gold	40·0	11,839	56·6	9	236·9	77,599	426·8	293·3	95,529	436·5
Ashanti	26·5	16,510	68·5	9	225·0	146,706	630·7	221·0	142,092	581·2
Bibiana (1927)	30·0	6,250	8·2	9	269·0	56,850	115·7	273·0	56,805	81·9
Bremang*	801·7	4,776	22·4	6	4161·7	18,655	46·6	2586·9	10,623	L17.3
G.C.M. Reef	8·5	3,102	5·9	12	114·2	44,018	141·4	102·2	45,590	143·2
Konongo	3·5	3,040	15·3	9	30·7	28,450	141·9	24·7	25,356	115·3
Lyndhurst Deep	0·9	1,070	5·0	9	9·1	10,228	52·8	9·2	10,545	50·7
Taquah & Abos.	28·5	5,885	3·5	3	86·0	17,208	5·8	81·0	17,792	13·3

*Cu. yds. dredged. L denotes loss. Profit figures include premium revenue.

AUSTRALIAN GOLD

Company	4 weeks to June 14 1955		4 weekly period since year-end	Current Financial Year Total to date		Last Financial Year Total to date	
	Tons (000)	Yield (oz.)		Tons (000)	Yield (oz.)	Tons (000)	Yield (oz.)
Central Norseman	12·3	6,740	3	37·1	20,606	36·2	19,724
Central Victoria*	91·8	349	3	259·3	1,040	635·3	1,773
G.M.'s of Kalgoorlie†	38·3	8,809	3	110·7	27,138	—	—
Great Boulder *a*	102·2	25,564	6	210·4	50,466	211·3	49,120
Morning Star	1·3	335	3	4·2	1,613	4·1	3,332
New Coolgardie	5·0	2,468	3	14·2	6,243	13·9	7,056
North Kalgurli	28·2	5,822	6	155·7	—	—	—
Sons of Gwalia	8·6	1,303‡	6	55·1	11,451	46·9	10,015

*Cu. yds. dredged.
†Figures include outputs from Boulder Perseverance, Kalgoorlie Enterprise, and South Kalgoorlie Cons. Last year's figure not comparable.
‡Low output due to shaft repairs following skip derailment and very heavy rains causing flooding.
a Quarterly. Figures to May 17.

SOUTHERN RHODESIAN GOLD

Company	June, 1955			Months since year end	Current Financial Year Total to date			Last Financial Year Total to date		
	Tons (000)	Yield (oz.)	Profit (£000)		Tons (000)	Yield (oz.)	Profit (£000)	Tons (000)	Yield (oz.)	Profit (£000)
Arcturus	3·0	970	34·9	12	36·6	11,098	68·1	36·7	—	37·8
Cam & Motor	25·0	7,732	41·1	12	292·3	90,940	494·7	291·2	91,917	542·5
Falcon Mines	18·0	3,195	†9·1	9	156·3	28,299	98·9	151·4	24,887	70·8
Globe & Phoenix	6·0	3,520	23·9	6	36·3	21,193	141·1	36·4	21,581	140·1
Motapa Gold*	16·1	2,330	1·1	6	94·5	13,289	3·4	109·5	14,976	94·5
Muriel Mine	3·6	1,336	10·0	12	49·6	12,723	120·6	28·7	—	97·7
Pheonix Prince *a*	33·5	3,987	10·8	3	33·5	3,987	10·8	32·6	3,985	11·8
Tebekwe	7·5	1,062	1·6	12	87·6	11,979	16·2	96·7	—	29·4

*Excluding premium gold sales.
†A further £569 for gold produced in April not included.
L indicates a loss.
a Quarterly

MISCELLANEOUS GOLD

Company	June 1955		Months since year-end	Current Financial Year Total to date		Last Financial Year Total to date	
	Tons (000)	Yield (oz.)		Tons (000)	Yield (oz.)	Tons (000)	Yield (oz.)
Br. Gv. Consol*	170·8	1,435	6	1000·4	8,478	1143·7	10,320
Clutha River*	000·0	565	3	000·0	1,340	719·0	985
Frontino	11·7	5,068	6	69·9	36,325	60·9	34,739
Kentan (Geita)	23·8	3,450	12	273·3	41,087	256·0	38,942
St. John d'El Rey	25·3	112	6	144·4	618·3	152·9	696.6

*Cu. yds. dredged.

INDIAN GOLD

Company	June 1955		Months since year-end	Current Financial Year Total to date		Last Financial Year Total to date	
	Tons (000)	Yield (oz.)		Tons (000)	Yield (oz.)	Tons (000)	Yield (oz.)
Champion Reef	15·3	5,042	6	88·6	31,368	88·3	34,137
Mysore	17·2	5,391	6	94·9	29,918	106·1	40,352
Nundydroog*	17·9	6,282	6	106·5	32,844	127·8	36,263

*Includes tailings.

TIN OUTPUT IN TONS OF TIN CONCENTRATES

Company	June	Months since year end	Financial Year to Date		Company	June	Months since year end	Financial Year to Date	
			This	Last				This	Last
EASTERN					Tekka*	37½	3	37½	36½
Ampat	113	6	666½	546½	Tekka T.*	85	9	211	335
Ayer Hitam*	223½	12	1410½	1249½	Temoh*	69½	12	224	94½
Berjuntai	89½	2	172½	111	Tongkah	50½	12	492½	436½
Chenderiang*	59½	3	59½	39½	Tronoh*	545	6	1187	1491½
Gopeng Cons.*	183½	9	556½	407½					
Hongkong Tin*	76½	9	219	149½	**NIGERIA**				
Idris Hyd.*	72½	6	147½	130½	Amal. Tin	320	3	918	937
Ipoh Tin*	35	3	99	113½	Amal. Tin†	67½	3	182½	146
Kamunting	104½	3	284	277	Bisichi	50½	6	415½	270
Kent (F.M.S.)*	68½	6	140	183½	Bisichi†	29½	6	221½	113
Kepong*	90½	12	284½	247	Ex-Lands	35	6	319	325
Killinghall*	63½	9	296½	439½	Gold & Base	49	6	266	231
Kinta K.	8½	3	30½	71	Gold & Base†	12	6	82½	53½
Kinta T.	35½	6	186½	151½	Jantar	18	9	179	152
Klang River	18½	3	60½	115½	Jantar†	19	9	146	160
Kuala K.	152	3	489½	593½	Jos Tin	9½	11	125½	134½
Kuchai	106½	9	494	227½	Kaduna P.	8	6	36	35
Larut	76½	6	543½	515½	Kaduna S.	20	6	143	131½
Lower Perak	162½	2	330½	412	Keffi†	25	3	104	89½
Malayan Tin*	415½	12	1583½	1883½	Lond. Nig.	16	3	56½	57
Malaysiam	12½	9	38½	28½	Naraguta Ex.	7½	6	34	25½
Pahang	220	11	2410	2420	Naraguta K.	7½	6	60½	76½
Pengkalen*	131½	9	366½	399	Naraguta T.	12½	6	73½	97
Petaling*	543½	9	1616½	1130	Naraguta T.†	14	6	48½	40
Puket Tin*	187½	6	375½	307½	Ribon	13½	3	41	22
Rahman H.	32½	12	416	480½	Ribon†	1½	3	4	nil
Rambutan*	59½	12	233	156½	Rukuba	1½	3	3½	5½
Rantau	75½	12	755½	782½	S. Bukeru	4	6	34½	39½
Rawang Conc.	22	3	78½	174½	S. Bukeru†	½	6	5	2
Rawang Tin	103½	3	341½	137½	Tinfields of Nig.	1½	3	4	6½
Renong	69½	12	409½	1109	Tinfields of Nig.†	1½	3	8	7½
Selayang Tin*	68½	9	195	164	U. Tin	10½	12	141½	93
S. Kinta	267	3	861½	1317½	U. Tin†	7	12	42	1½
S. Malayan*	792½	12	2968	2917½					
Siamese Tin	187	6	1114	948½	**MISC.**				
S. Tronoh*	201½	6	643½	427½	Beralt Tin	13	3	33	14
Sungei Besi*	265½	3	265½	268½	Beralt Tin‡	153	3	493	469
Sungei Kinta	29½	6	135½	132½	Creevor	55	3	161	162
Sungei Way*	470	12	1575	1225½	Sth. Crofty Tin	61½	6	335½	300
Taiping	57½	6	344½	326½	Sth. Crofty Tin‡	½	6	1½	4½
Tambah	12½	6	79½	123½	Tin & Assoc. Min	8½	3	30	§21½
Tanjong	50½	6	516½	423½	Tin & As. Min.†	9	3	28½	§23½

* Quarterly
† Columbite
‡ Wolfram
§ Figures for 2 months.

OIL OUTPUT

Company	June (in tons)	Months Since Year End	Cumulative Totals (in tons)	
			This year to date	Last year to date
Anglo Ecuadorian	26,449	3	80,163	80,602
Apex Trinidad	36,053	9	336,029	334,798
Attock Oil*	48,209	6	95,050	89,807
Kern Oilfields	25,512	1	25,512	26,719
Kuwait Oil§	5,060,195	5	22,748,276	18,256,123
Lobitos Oil	42,466	6	261,571	245,481
Trinidad Central	7,758	6	49,413	53,005
Trinidad Leaseholds	73,881	12	935,741	907,896
Trinidad Petroleum	40,501	11	448,929	434,086
Ultramar Oil†	102,427	6	642,386	637,529
Qatar Petroleum§	454,263	5	2,150,317	1,881,234

Note : 1 ton taken to equal seven barrels.
†Output figures are for S.A.P. Las Mercedes in which Uttramar holds a 50 per cent interest.
*Quarterly.
§One month late.

COAL OUTPUT

Company	June (in tons)	Months Since Year End	Cumulative Totals (in tons)	
			This year to date	Last year to date
Amal. Coll. of S.A.	583,785	6	3,463,041	3,419,040
Apex	87,283	6	510,955	476,915
Blesbok	44,274	6	257,181	273,146
Coronation	86,328	6	552,535	520,755
Natal Navigation	109,336	12	1,235,499	1,286,578
New Clydesdale	67,030	12	881,240	856,175
New Largo	98,202	6	529,253	456,904
S.A. Coal Est.	135,507	12	1,622,885	1,639,616
Springbok	67,413	6	429,291	411,382
Transvaal & Delagoa	122,785	10	1,327,600	1,184,840
Van Dyks Drift	51,892	6	360,944	292,015
Vierfontein	108,461	6	645,458	429,398
Vryheid Cor.	47,972	6	272,323	250,693
Vryheid Cor.*	40,295	6	227,998	210,047
Wankie Coll.	270,569	10	2,713,646	2,007,638
Wankie Coll.*	15,838	10	167,849	116,478
Witbank	149,088	6	892,043	796,213

* Coke

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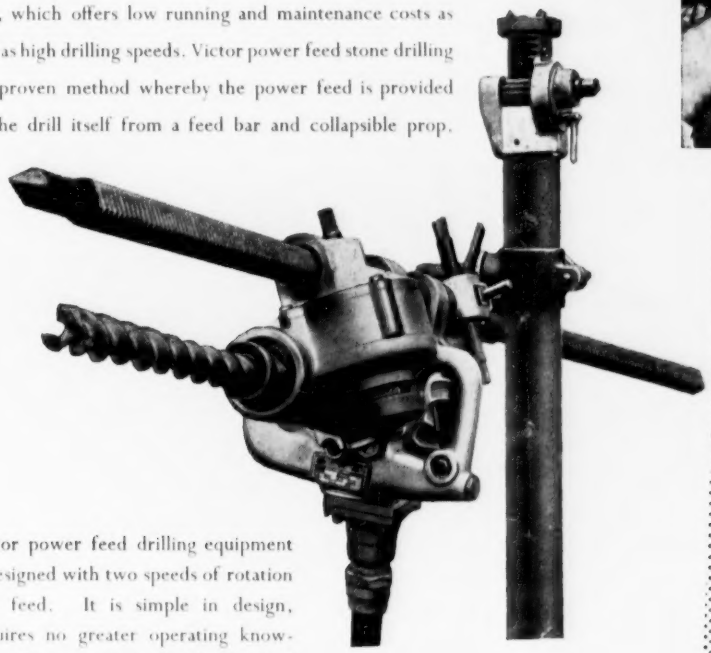

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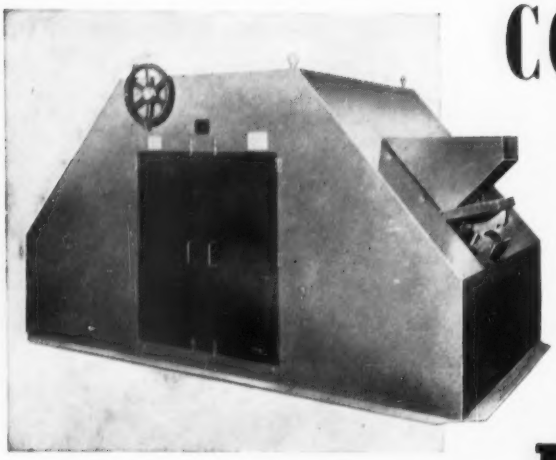

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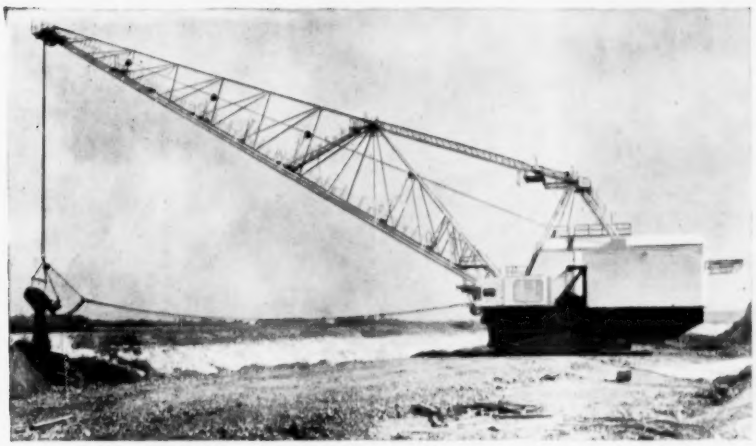

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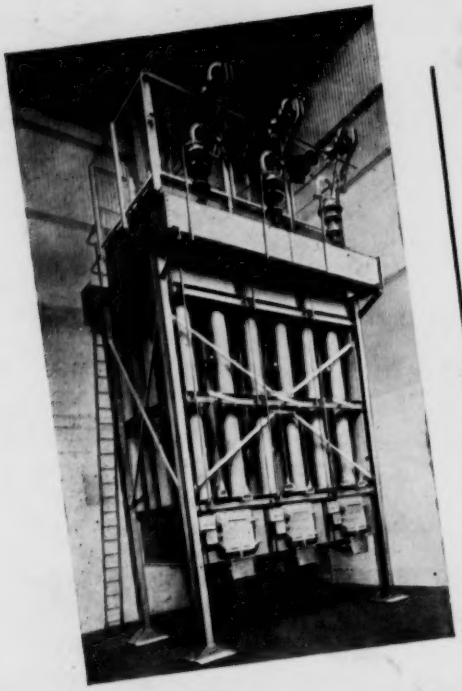

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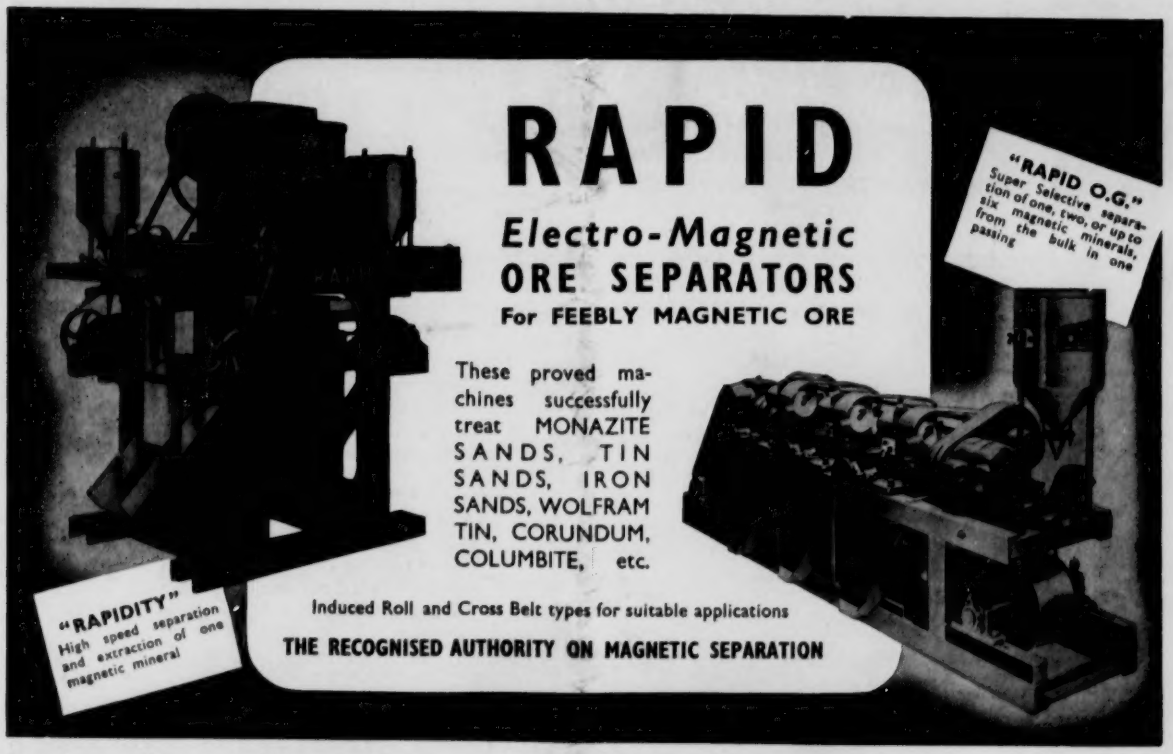
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